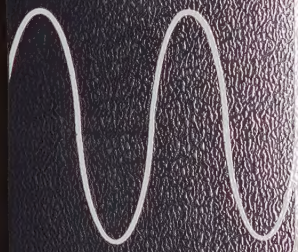
INSTRUCTION MANUAL

SD129
SINE/RANDOM SIGNAL VIBRATION PROTECTOR

(S/RSVP)



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SD129
SINE/RANDOM SIGNAL VIBRATION PROTECTOR
(S/RSVP)

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SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO
Post Office Box 671
San Diego, California 92112
Telephone: (714) 565-8211
TWX: 910-335-2022

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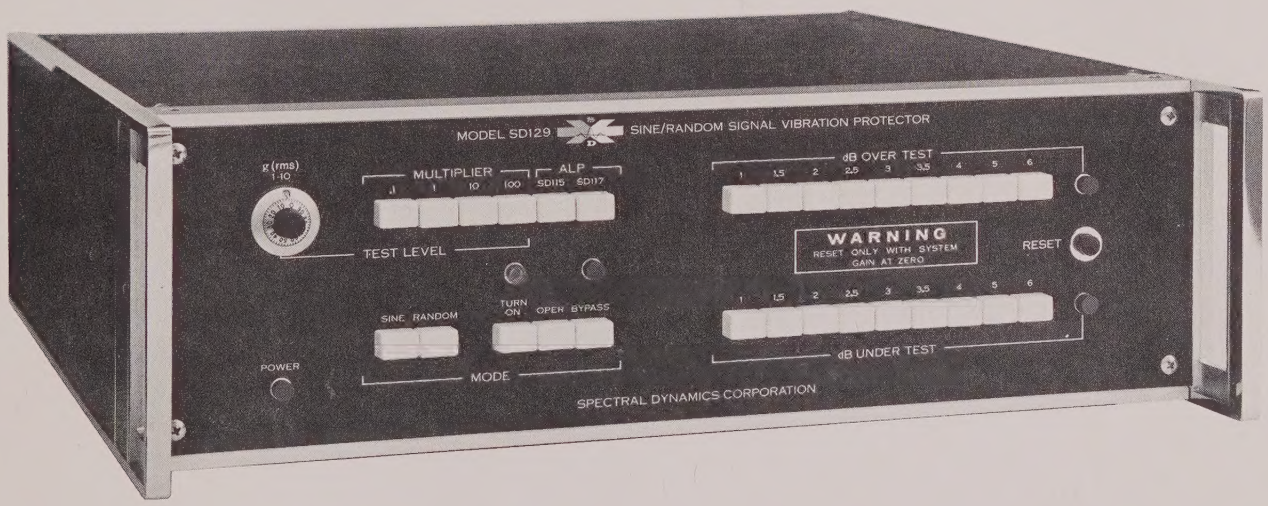

MODEL SD129 SINE/RANDOM SIGNAL VIBRATION PROTECTOR

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MANUAL CHANGES

Model: SD129
Unit Serial: As Applicable
Manual Edition: ---

Each change listed below must be individually analyzed for applicability in accordance with "Action" directed relative to unit serial number and/or documentation affected.

Change #1	Effectivity:	S/N 096 & on.
ECO–1738 (3-11-74)	Action:	Schematic, DWG. NO. 14186(A), Circuit Card A5 (Power Supply Assy. 14188-1); Change C3 and C4 from .01 μF to .022 μF.

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*(Revised 2-6-73)

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(Located at rear of manual)

DWG. NO. 14192	Circuit Card A1	Amplifier/Rectifier	Assembly No. 14194-1
DWG. NO. 14191	Circuit Card A2	Logic	Assembly No. 14190-1
DWG. NO. 14197	Circuit Card A3	AGC Amplifier	Assembly No. 14196-1
DWG. NO. 14198	Circuit Card A4	Frequency to DC	Assembly No. 14200-1
DWG. NO. 14186	Circuit Card A5	Power Supply	Assembly No. 14188-1
DWG. NO. 14203	Circuit Card A6	Upper Switch	Assembly No. 14202-1
DWG. NO. 14204	Circuit Card A7	Lower Switch	Assembly No. 14206-1
DWG. NO. 14215	Interconnecting Diagram		

RECEIVING INSPECTION PROCEDURE

The Model SD129 Sine/Random Signal Vibration Protector is shipped fully assembled, packed in a polystyrene case designed to protect it against all normal shipping hazards. Immediately upon receipt, inspect the exterior of the shipping case and note any visible damage. Keep all forms and invoices attached to the shipping case. Remove the instrument from the shipping case and test its functional operation in accordance with Section II of this manual. If shipping damage is apparent, file a claim with the carrier's claims agent and send a copy to Spectral Dynamics Corporation. Be sure to include the instrument name, model number, and serial number on all correspondence. Spectral Dynamics Corporation will advise the buyer what should be done; arrangements for repair or replacement will be made as applicable.

WARRANTY POLICY

All Spectral Dynamics products are warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, or, in the case of certain components listed in some of the operating manuals, for the specified period. We will repair or replace products which prove to be defective during the warranty period, providing the failure or damage has not been caused by misuse or abnormal operating conditions. Fuses and lamps are specifically excluded from warranty. If the malfunction or a portion thereof is determined by Spectral Dynamics Corporation to have been caused by misuse or abnormal conditions of operation, an estimate of cost to repair will be submitted to the purchaser for approval before beginning any repair work.

Liability under this warranty is limited to servicing and adjusting the instrument returned to the factory, with transportation charges prepaid by the purchaser. No other warranty is expressed or implied. We are not liable for consequential damages.

If any malfunction develops, notify Spectral Dynamics Corporation or its representative in your area, giving details of the problem, and the name, model and serial number of the equipment. Upon receipt of this information, service data or shipping instructions will be provided.

RETURN SHIPMENT PROCEDURE

On receipt of shipping instructions, forward the instrument prepaid via air freight to the factory or authorized repair station indicated on the instructions. Replace the instrument in its original shipping case, or surround with two to three inches of shock absorbing material and then pack it in a heavy-weight cardboard box, wooden box, or other strong container.

SECTION I

GENERAL INFORMATION

1.1 INTRODUCTION

The Model SD129 Sine/Random Signal Vibration Protector (S/RSVP) provides safety protection for the components in a sine or random vibration analysis system. Smooth compression (≈80 dB) of the drive signal is accomplished within 1 second (random mode) or at a rate proportional to frequency (sine mode), if the operating test level exceeds or drops below a preset dynamic testing range.

Figure 1-1 shows a typical application of the SD129 operating as the protective coupling between an automatic equalizer/analyzer and the shaker power amplifier in a random vibration test system. Figure 1-2 shows a typical application of the SD129 in a sine vibration test system. In Figure 1-3, the sine vibration test system is enhanced by the addition of an Automatic Level Programmer.

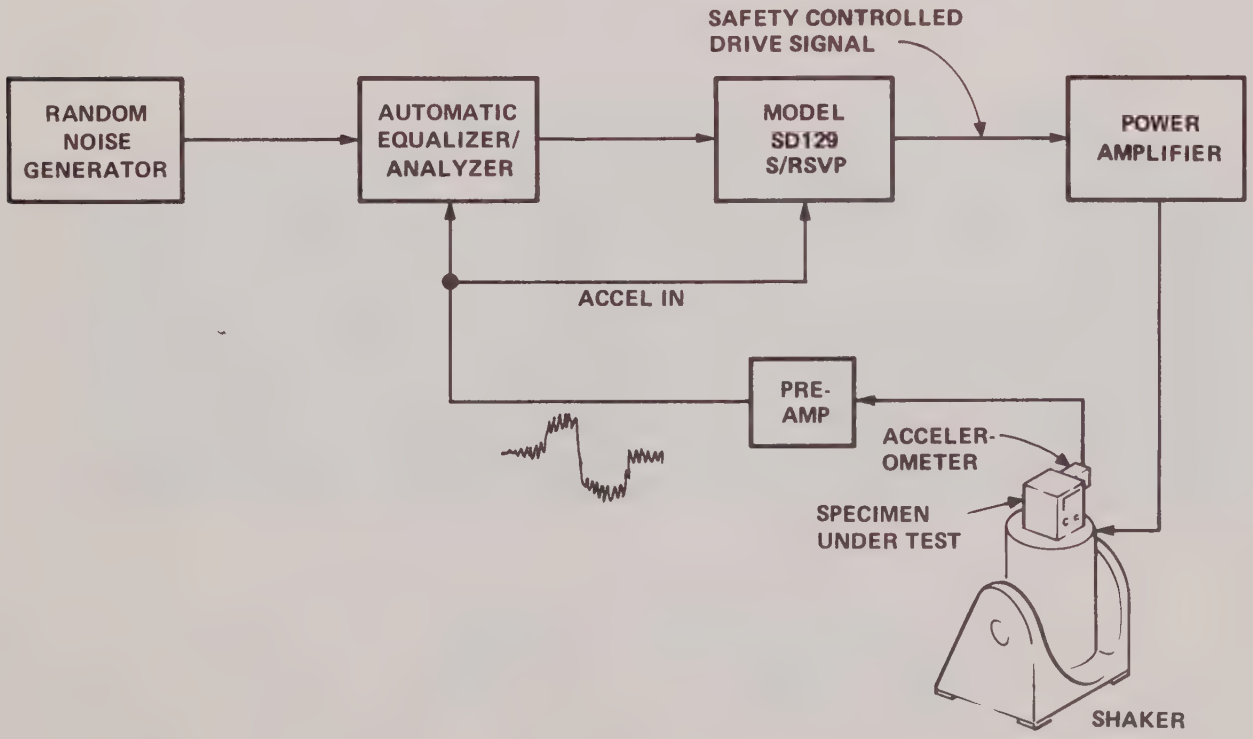

Figure 1-1. System Protection Concept, Random Signal Mode

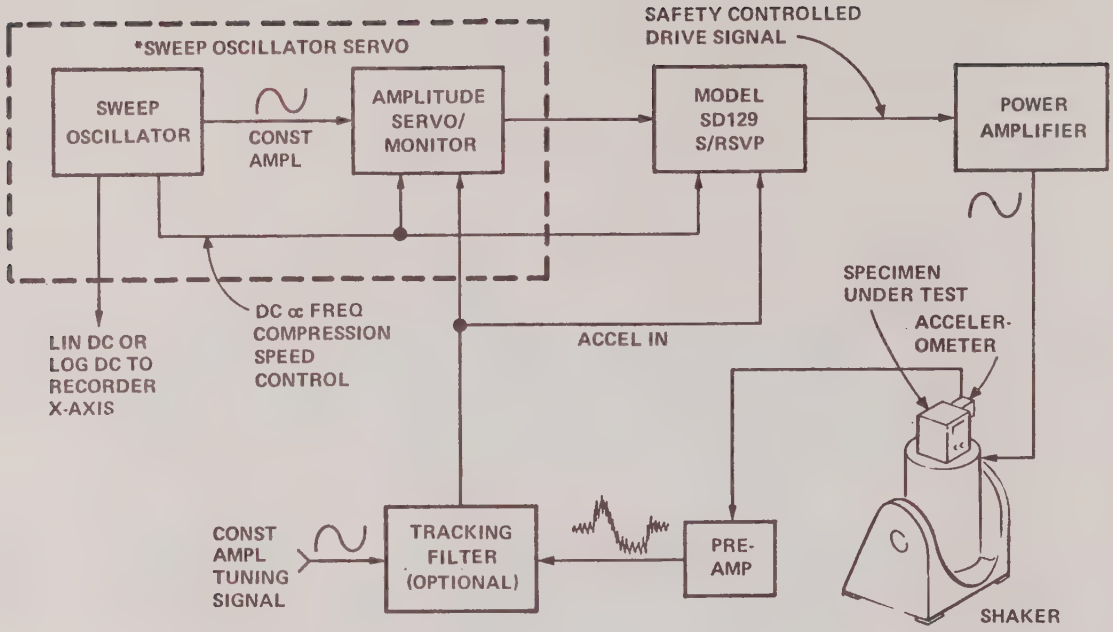

Figure 1-2. System Protection Concept, Sine Signal Mode

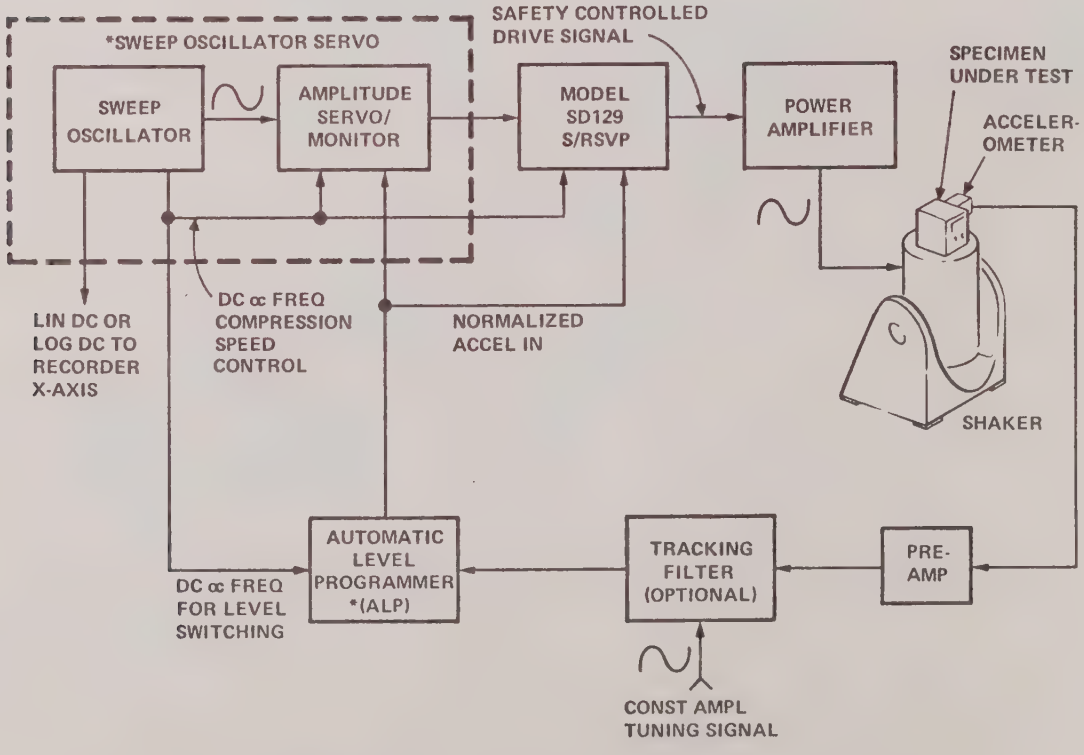

Figure 1-3. System Protection Concept, Sine Signal Mode, With ALP

Notice that in each test configuration, the SD129 is connected in series between the shaker drive signal source and the shaker power amplifier. It is also part of a closed-loop servo circuit that includes the power amplifier, shaker, specimen under test, accelerometer attached to the specimen, and the accelerometer preamplifier. Hence, if the accelerometer senses that the preset test level has exceeded or dropped below the SD129 preset dynamic testing range, the SD129 will compress the drive signal approximately 80 dB.

The SD129 also provides instantaneous or 0.5-second-delay relay contacts that can be used to completely shut down the system.

1.2 FRONT PANEL FUNCTIONAL DESCRIPTION

Figure 1-4 illustrates the front panel and is followed by a brief description of each of the front-panel functions.

Figure 1-4. Front Panel

POWER Indicator

Glows red when power is applied to the unit. Note that there is no power switch on the SD129; power is normally supplied via the system main power control switch.

TEST LEVEL Controls

MULTIPLIER push button switches provide selection of four test level control ranges in g(rms): .1 to 1, 1 to 10, 10 to 100, and 100 to 1000.

The g(rms) 1-10 control, a linearly calibrated 10-turn potentiometer, provides vernier adjustment of the vibration test level over each of the four control ranges described above.

The test level in g(rms) equals the selected MULTIPLIER value times the g(rms) reading. For example, if it is desired to control at a test level of 45g, press the MULTIPLIER 10 push button and set the g(RMS) control to 4.50 (4 in the window and 50 on the dial).

Note that the SD129 is calibrated in g(rms); therefore g(peak) values must be multiplied by 0.707.

ALP SD115/SD117 Push Buttons

Pressing either push button overrides the variable input attenuation circuit and replaces it with a fixed attenuation value that is compatible with the signal output from the particular unit, SD115 or SD117, being used. (Internal calibration potentiometers are provided for system precalibration, as necessary. Normally set at factory to accept 1V p-p from an SD115, or 17 mV p-p from an SD117.)

MODE Push Button Switches and Indicators

SINE MODE Push Button

Is depressed when a sine wave system drive signal is used. In SINE MODE, when an OVER TEST or UNDER TEST condition is detected, the rate of compression is proportional to frequency; i.e., at 10 Hz the drive signal is compressed 80 dB in approximately 1 second or less; at 100 Hz, 0.3 second or less, etc. The controlling d-c voltage proportional to frequency, normally supplied from the SD104 or SD114, is applied to rear chassis connector J6, SYSTEM TUNING IN/DC $\propto$ FREQ IN, and S7 is set to DC. If a control voltage is not available, S7 is set to AC and the control voltage is developed internally from the SYSTEM TUNING IN applied to J6.

RANDOM MODE Push Button

Is depressed when a random-type system drive signal is used. When an OVER TEST or UNDER TEST condition is detected, the drive signal is compressed 80 dB in approximately 1 second or less. (In RANDOM MODE, the control circuitry concerned with the rear chassis connector J6 and S7 described above is inoperative.)

TURN ON Push Button and Indicator

When depressed, system can be brought "on the air", if the ACCEL IN signal is not greater than the preset TEST LEVEL plus dB OVER TEST limit setting. Amber indicator flashes at approximately 1-second intervals. In this mode, system protection is afforded (and indicated) if an overtest condition occurs; however, no indication is given for an undertest condition.

OPER Push Button

Normally pressed after the system has reached the preset TEST LEVEL, or at least slightly above the selected undertest limit level. In OPER MODE, system is protected from both an undertest and an overtest condition.

BYPASS Push Button and Indicator

When depressed, the SINE/RANDOM IN signal at J2 is routed directly to J3, SINE/RANDOM OUT. Assuming the POWER indicator is lighted, the red BYPASS indicator flashes at approximately 1-second intervals to indicate that no protection is being provided.

dB UNDER TEST Push Buttons and Indicator

Push buttons are used to select one of nine undertest dynamic operating limits (referenced to the TEST LEVEL control settings). The UNDER TEST indicator lights to indicate that the dynamic testing level has fallen below the preset level; also, Relay K1 is actuated, the SINE/RANDOM OUT signal is compressed approximately 80 dB (as described above for the particular mode), and then Relay K2 is actuated in approximately 0.5 second. This condition of safety remains until the system is reset.

RESET Push Button

> **WARNING**
>
> RESET ONLY WITH SYSTEM GAIN AT ZERO

Used to reset the SD129 protective circuitry after an undertest or overtest condition has occurred. In OPER mode, the SD129 cannot be reset until the dynamic test conditions are returned to the preset operating range. Normally, TURN ON mode is used to bring the system "on the air". In this mode, the SD129 can be reset if the dynamic test conditions are below the OVER TEST limit.

dB OVER TEST Push Button and Indicator

Push buttons are used to select one of nine overtest dynamic operating limits (referenced to the TEST LEVEL control settings). The OVER TEST indicator lights to indicate that the dynamic testing level has just exceeded the preset level. Relay action, signal compression, and reset requirements are the same as described above for the UNDER TEST condition.

1.3 REAR OF CHASSIS FUNCTIONAL DESCRIPTION

Figure 1-5 illustrates the rear of the instrument chassis and is followed by a brief description of each of the input/output functions.

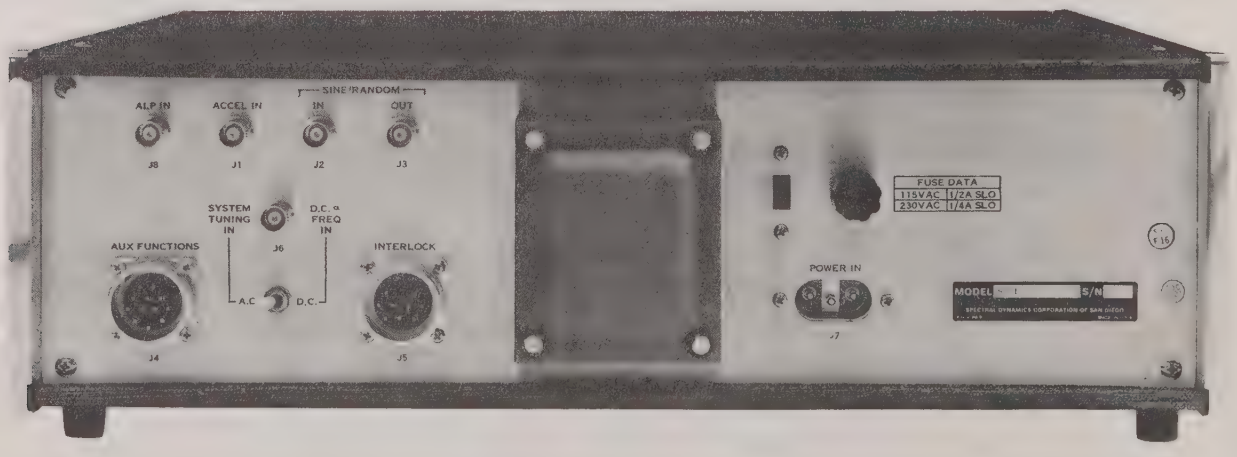

Figure 1-5. Rear of Chassis

ACCEL IN (J1)

Accepts the pre-amplified control-accelerometer signal, which is used to control the operation of the SD129 system protective circuitry.

SINE/RANDOM IN (J2)

Accepts the sine or random system drive signal for controlling by the SD129 compression circuitry. The gain through the unit, from J2 to J3, is nominally unity until a dynamic test limit is exceeded; then the drive signal is compressed approximately 80 dB as described in Paragraph 1.3 under "MODE Push Button Switches and Indicators".

SINE/RANDOM OUT (J3)

Provides controlled output of the signal applied to SINE/RANDOM IN connector J2 described above. (Normally connected to the P.A. input.)

AUX FUNCTIONS (J4)

Accepts Cannon GK-12-21C-1/2 connector for interconnecting K1 and K2 relay switching contacts to system components that are to be safety protected. (See drawings in Section II and schematic diagram for wiring information.)

SYSTEM TUNING IN/DC ∝ FREQ IN (J6) and A.C./D.C. Switch S7

Refer to description under "MODE Push Button Switches and Indicators", Paragraph 1.2.

INTERLOCK (J5)

Accepts Cannon GK-9-21C-1/2 connector for interconnecting a set of normally open and normally closed (SPDT) relay K1 contacts which actuate simultaneously with the detection of either an over or under limit condition. (See Figure 2-1 in Section II for wiring information.)

POWER IN

Accepts 3-wire plug and cable (supplied) for applying 115/230 Vac 50—60 Hz primary input power. Center terminal is chassis ground. Uses Belden No. 17258-S cable.

ALP IN (J8)

* → Accepts normalized accel signal from Automatic Level Programmer (ALP) when ALP push button is pressed. (Connect to J6 on SD115, or J8-13 on SD117.)

FUSE

Contains 3AG-type, SLO BLO fuse; 1/2A for 115V operation or 1/4A for 230V operation.

230/115 Switch

Facilitates changeover of primary power input circuit for either 230V or 115V operation. Proper input power to be applied shows in window; screwdriver blade slot is up for 115V operation and down for 230V operation.

1.4 SPECIFICATIONS

INPUTS

Sine Input
(from manual or automatic equalizer/analyzer)

Level	10 Vrms maximum
Impedance	50k ohms
Dynamic Range	60 dB
Frequency Range	5 Hz to 10 kHz

Random Input
(from manual or automatic equalizer/analyzer)

Level	2 Vrms maximum
Impedance	50k ohms
Dynamic Range	60 dB
Frequency Range	5 Hz to 10 kHz

Accel Input

Sensitivity	10 mV rms/g rms
Level	Adjustable 0.1–1000g (rms)
Impedance	100k ohms
Frequency Range	5 Hz to 10 kHz

*→ System Tuning Input

Level	0.1 to 10 Vrms
Impedance	100k ohms
Frequency Range	5 Hz to 5 kHz

DC ∝ Frequency Input

Sensitivity	2 mV/Hz
Level	+10 mV to +10 Vdc
Impedance	300k ohms

OUTPUTS

Sine Output

Gain . . . . . Unity ±1 dB

Level . . . . . 10 Vrms maximum

Impedance . . . . . 560 ohms coupled through 50 μF (8 mA rms maximum)

Frequency Response . . . . . 5 Hz to 10 kHz (±0.5 dB)

Dynamic Range . . . . . 80 dB

Distortion . . . . . Less than 0.5%

Compression Time . . . . .

Frequency	Approx Time (second)
5 Hz to 10 Hz	1
100 Hz	0.3
1 kHz	0.035
5 kHz to 10 kHz	0.01

Random Output

Gain . . . . . Unity ±1 dB

Level . . . . . 2 Vrms maximum

Impedance . . . . . 560 ohms coupled through 50 μF (8 mA rms maximum)

Frequency Response . . . . . 5 Hz to 10 kHz (±0.5 dB)

Dynamic Range . . . . . > 80 dB

Compression Time . . . . . Approximately 1 second or less for 80 dB compression

Relay Outputs

(Multi-Pin Connector on Rear of Chassis)

Normally open and normally closed (SPDT) relay contacts which actuate simultaneously with detection of either over or under limit condition.

Contact Ratings . . . . . 115 Vac at 0.25A, 0.2 ohm maximum

OPERATIONAL MODES

Bypass	Switch selectable with visual indication
Turn On	Switch selectable with visual indication for protection in overtest condition only.
Operate	Switch selectable for protection in both overtest and undertest conditions.

PRESET LIMITS

Overtest and Undertest Limits (dB)	1, 1.5, 2, 2.5, 3, 3.5, 4, 5, 6
Preset Level Accuracy	±0.5 dB

POWER	105–125/210–250 Vac switch selectable on rear of chassis; 50/400 Hz at ≈20W.

DIMENSIONS	Height	13,3 cm (5-1/4")
	Width (Std. Rack Panel)	48,3 cm (19")
	Depth (w/o Connectors)	35,6 cm (14")
	Shipping Weight	5,9 kg (13 lbs)

SECTION II

OPERATION

2.1 GENERAL

The operation procedure described here is basic to the Model SD129 S/RSVP and is not intended to cover its many possible applications as a safety device. Refer to Section I of this manual for the description of all front-panel and rear-chassis connectors, controls, switches, and indicators.

2.2 PRELIMINARY POWERING

Check that the 115/230 switch on the instrument rear chassis is set to indicate the input line voltage, and that the proper value fuse is installed.

CAUTION

The SD129 does not have a power switch and is powered when the line cord is connected to the primary power source. When installing the unit, facilities should be made to control its power by means of the system master power switch.

2.3 OPERATIONAL CHECKOUT PROCEDURE

a. Connect the SD129 and test equipment as shown in Figure 2-1. The test equipment recommended is shown; however, test equipment having equal or better operating characteristics may be substituted.

NOTES

1) When constructing the relay test lamp circuit, make the leads from P4 and P5 long enough to allow placing the test lamps in front of the oscilloscope; then both relay action and signal compression can be observed simultaneously.

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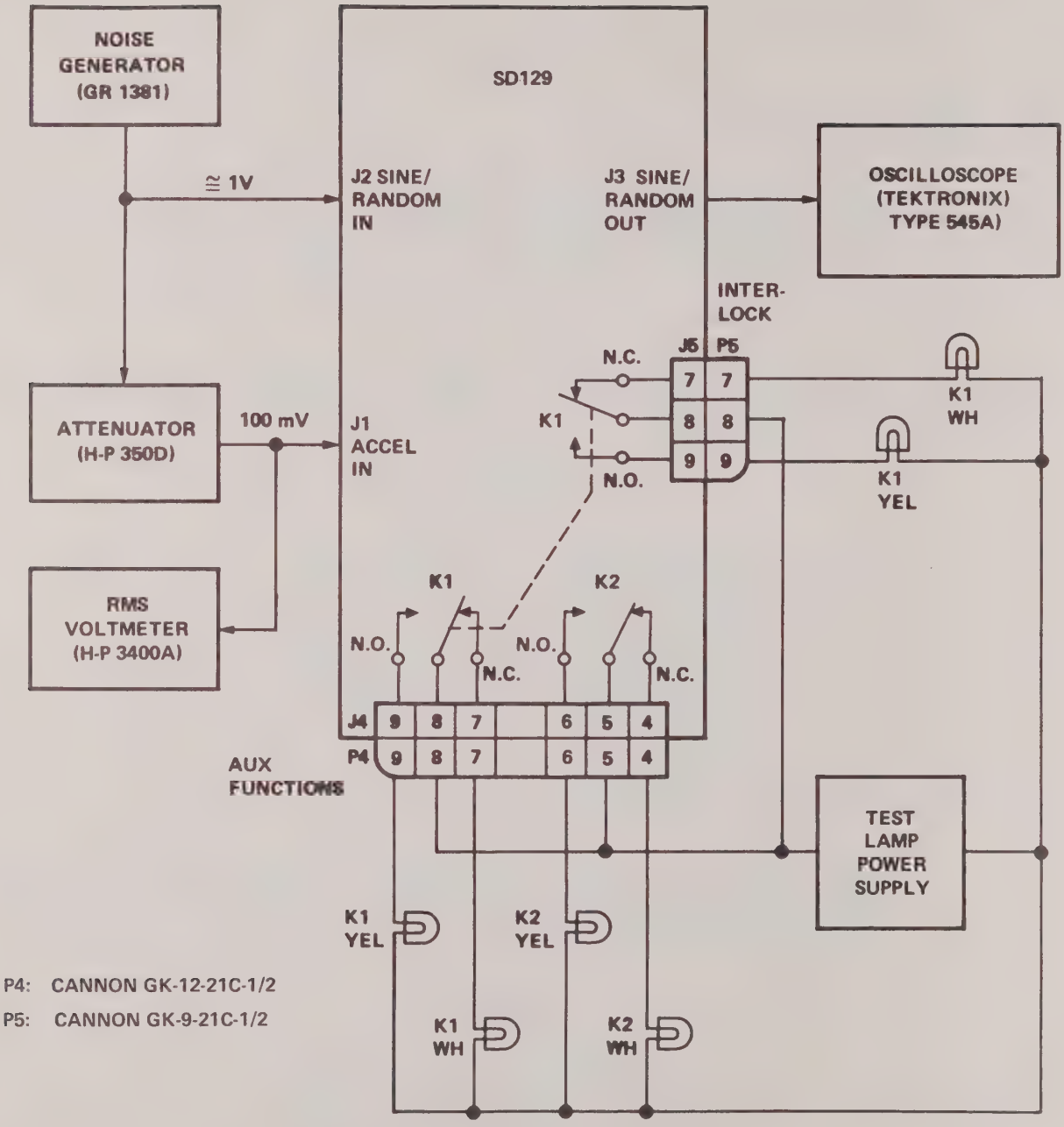


Figure 2-1. Equipment Setup for Operational Checkout

2) If the test circuit is not constructed, a pair of ohmmeters may be used, one connected across the normally open (N.O.) contacts of each relay, K1 and K2.

b. Apply power to all equipment and allow proper warmup period. The SD129 requires only a 10-minute warmup.

c. Press MODE BYPASS push button; the red BYPASS indicator should flash at approximately 1-second intervals. Both K1 (WH) and K2 (WH) test lamps should be lighted.

d. On SD129, set the g(RMS) control to 10; press in the following push buttons:

MODE	RANDOM
MULTIPLIER	1
dB UNDER TEST	1.5
dB OVER TEST	3

e. Adjust noise generator for 2-kHz bandwidth and 3σ clipping.

f. Adjust noise generator and attenuator controls for $\approx$1 Vrms at J2 and 100 mV $\pm$1 mV at J1. (The attenuator will be at $\approx$20 dB.)

g. Calibrate the oscilloscope and observe $\approx$1 Vrms random noise signal at J3; there should be very little, if any, clipping.

h. Press MODE TURN ON push button; amber indicator should flash at $\approx$1-second intervals.

i. Press MODE OPER push button. If necessary, press the RESET push button so that neither UNDER TEST nor OVER TEST indicator is lighted. Now press MODE TURN ON and then OPER again; no transient or dropout of RANDOM OUT signal should be observed when switching between TURN ON and OPERATE.

j. Slowly increase the noise generator output until the OVER TEST indicator just lights; observe the following action:

1) RMS voltmeter at J1 should read 3 dB ±0.5 dB above the 100-mV preset level of Step f.

2) K1 (WH) test lamps should go out and K1 (YEL) test lamps should light.

3) The RANDOM OUT signal should decrease by at least 60 dB below 1 Vrms in ≈1 second.

4) After ≈0.5-second delay from condition 2), the K2 (WH) test lamp should go out and K2 (YEL) test lamp should light.

k. Disconnect the input from J1, ACCEL IN; the OVER TEST indicator should remain lighted (the UNDER TEST indicator should not light), and both K1 (YEL) and K2 (YEL) test lamps should remain lighted.

l. Reconnect the input to J1, and adjust the noise generator to 100 mV at J1.

m. Press the RESET push button; the OVER TEST indicator should go out, both K1 (WH) and K2 (WH) test lamps should light, and the output at J3 should rise to ≈1 Vrms in less than 1 second.

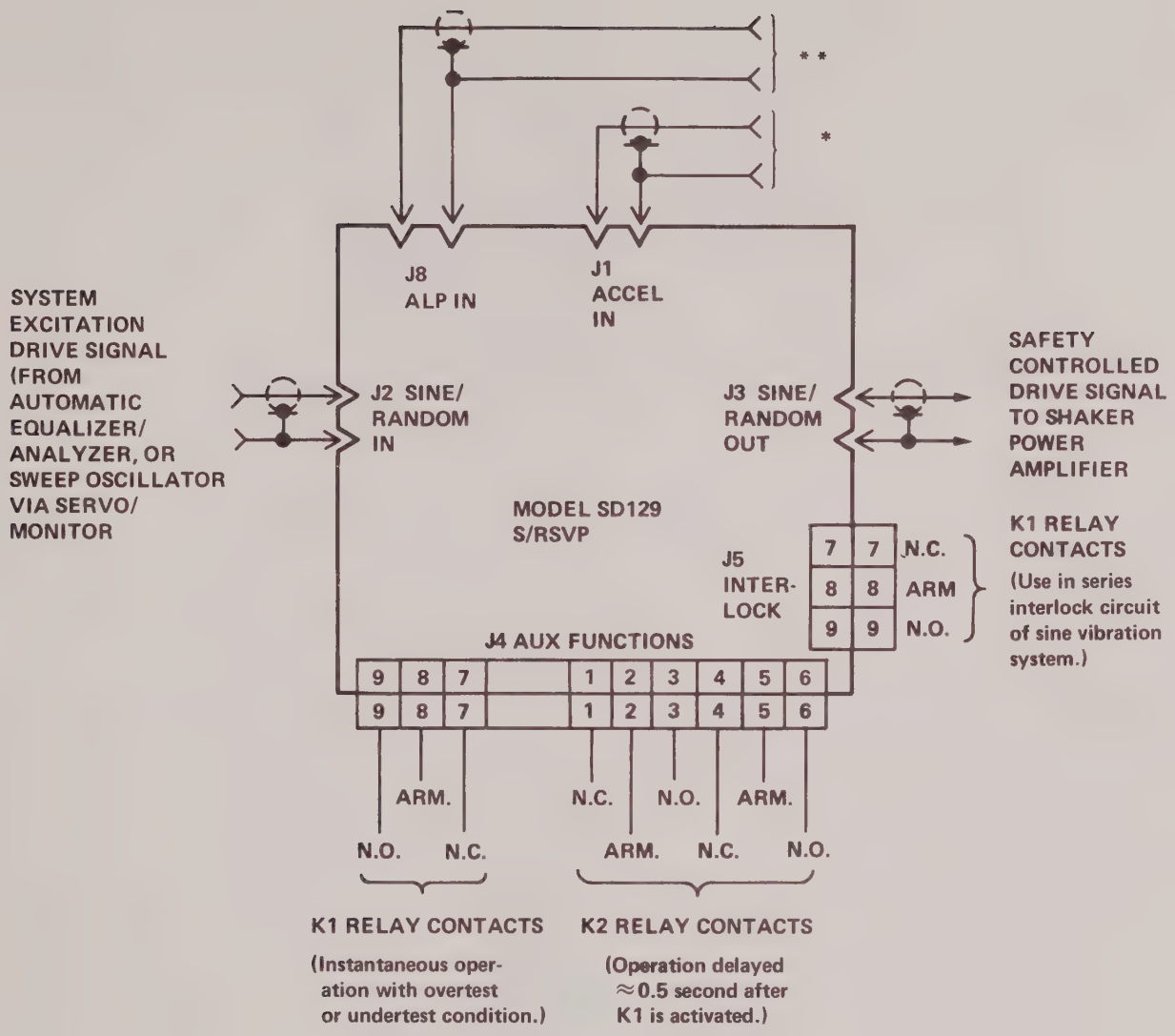
n. Slowly decrease the noise generator output until the UNDER TEST indicator just lights. The level at J1 should be 1.5 dB ±0.5 dB below 100 mV rms. All other conditions should be as described in Step j., 2) through 4).

o. Press the RESET push button and observe normal reset conditions as described in Step m.

p. Press MODE BYPASS and observe same level of random on oscilloscope as for OPER mode.

q. Press MODE TURN ON push button and repeat Step j. (Note that OVER TEST safety operation can occur in both TURN ON and OPER modes.)

r. Press MODE TURN ON, press RESET push button, then reduce noise generator output to zero. Note that UNDER TEST safety operation will not occur; it will only occur in OPER mode (Step n.).



NOTE: Although K2 is activated ≈0.5 second after K1, both relays are instantaneously deactivated when RESET push button is pressed.

OBSERVE RESET WARNING.

*Preamplified control accelerometer pickup signal at 10 mV/g, in RANDOM MODE or in SINE MODE without ALP.

**When using ALP, the normalized accelerometer signal from ALP is applied at J8. (This is not the 10 mV/g signal.)

Figure 2-2. Typical Application Connections

dB OVER TEST setting	1	1.5	2	2.5	3	3.5	4	5	6
TEST LEVEL multiplier	1.12	1.19	1.26	1.33	1.41	1.5	1.59	1.78	2

dB UNDER TEST setting	1	1.5	2	2.5	3	3.5	4	5	6
TEST LEVEL multiplier	0.89	0.84	0.79	0.75	0.71	0.67	0.63	0.56	0.5

For Example: A test is to be run at a 10 g(rms) TEST LEVEL: that is, the front panel g(RMS) dial is set to 10, and MULTIPLIER 1 push button is depressed. With the 3 dB OVER TEST push button depressed, the upper protection level in g(rms) is 10 times 1.41 (from the table for "3 dB OVER TEST") equals 14.1 g(rms). If the 4 dB UNDER TEST push button is depressed, then the lower protection limit in g(rms) equals 10 times 0.63 (from the table for "4 dB UNDER TEST"), or 6.3 g(rms).

2.5 OPERATION WITH AN ALP

When the SD129 is initially installed in a vibration system using an ALP unit such as the SD115 or SD117, the SD129 may have to be normalized to the particular ALP output level. With the system properly interconnected (see Figure 1-3), adjust the appropriate trim potentiometer on upper switch card A6 for desired operation (A6R6 for SD115 or A6R7 for SD117). See Calibration Procedure, Paragraph 4.2.4.

CAUTION

A step change in operating level is detected by the SD129 as either an UNDER TEST or OVER TEST condition; hence it will go into compression and shut down the system.

If step changes are present in the program to be run with the ALP, the SD129 may be temporarily placed in BYPASS MODE just before and during the step change function. After the step, the SD129 may be returned to OPER MODE, assuming that the levels are within the protective range of the SD129.

SECTION III

CONCEPT AND THEORY OF OPERATION

3.1 CONCEPT OF OPERATION

The SD129 Sine/Random Vibration Protector provides a means to safely shut down a vibration test system if either a preset undertest or overtest condition limit is exceeded. The SD129 operates as a variable gain amplifier between the system excitation signal source (sine wave or random signal generator) and the system shaker power amplifier. It provides unity gain until a preset test limit is exceeded; this condition is sensed from the output of an accelerometer that is attached to the specimen being vibrated. The SD129 then smoothly compresses the shaker drive signal approximately 80 dB in 1 second or less in RANDOM MODE, or at a rate proportional to frequency in SINE MODE; i.e., in approximately 1 second or less at 10 Hz, 0.3 second at 100 Hz, 0.1 second at 1000 Hz, etc. Also provided are instantaneous and delayed relay contact circuitry for complete shutdown of other system components as desired.

3.2 BLOCK DIAGRAM DESCRIPTION (See Figure 3-1.)

The preamplified output of a control accelerometer attached to a specimen being tested, is applied to rear-chassis connector J1, ACCEL IN. The signal is properly attenuated as a function of the MULTIPLIER push button switches, and is then amplified. When using the MULTIPLIER switches, the overall gain of the input amplifier is controlled by the front-panel g(RMS) control. Note that if either the SD115 or SD117 ALP push button is depressed, a mechanical interlock disengages J1 and the MULTIPLIER push button, and engages J8 through a fixed value of input attenuation. Also in each case, a fixed value of amplifier gain is switched in. (See Figure 3-1.) These gain values for SD115 and SD117 ALP inputs can be manually adjusted by trim potentiometers located internally on the MULTIPLIER/ ALP switch assembly.

The amplified a-c signal is squared and full-wave rectified to produce a d-c voltage that is proportional to the square of the ACCEL IN signal. Note that the range of this d-c voltage is the same for each range setting of the MULTIPLIER/ALP switches. It is this squaring of the essentially constant amplitude signal that provides true rms operation.

Before application to the comparators on the logic card (A2), the dc proportional to (ACCEL IN)^2 is passed through an RC filter. In RANDOM MODE, the "R" component is a fixed value. In SINE MODE, the "R" component is varied inversely as a function of the SINE INPUT frequency; that is, at a low frequency the "R" is higher to provide a longer time constant for proper filtering. As the frequency increases, the "R" component is decreased to provide a proportionally shorter time constant while still maintaining proper filtering. (The generation of the DC $\propto$ FREQ control voltage is described later.)

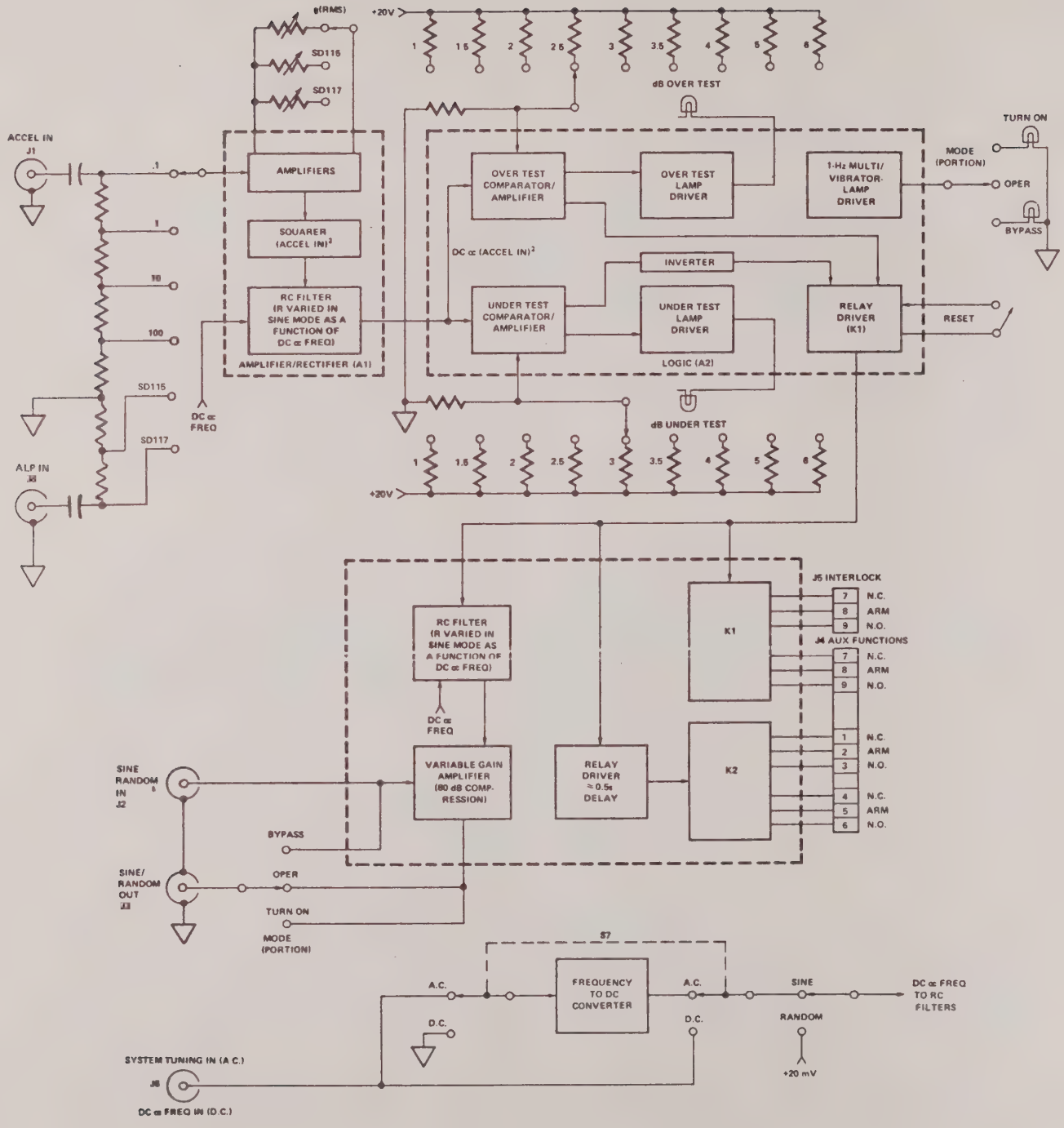


Figure 3-1. Functional Block Diagram — Model SD129 S/RSVP

The filtered dc $\propto$ (ACCEL IN)^2 is applied to one input of each of the undertest and overtest comparator/amplifiers on the logic circuit card. (See Figure 3-1.) Here it is compared to a reference d-c voltage selected by the dB UNDER TEST and dB OVER TEST push button switches respectively. If the dc $\propto$ (ACCEL IN)^2 falls below the dB UNDER TEST reference level or exceeds the dB OVER TEST level, the particular comparator/amplifier produces an output to the K1 relay driver, thus actuating relay K1. At the same time, the particular lamp driver is activated to turn on the front-panel UNDER TEST or OVER TEST indicator. The relay driver logic for K1 will hold K1 actuated until the front-panel RESET push button is pressed.

Simultaneously with the activation of relay K1, the variable gain amplifier is driven into compression. The rate of compression is determined by the mode of operation and a variable RC filter; the "R" component being controlled as a function of SYSTEM TUNING IN frequency. A fixed value is used in RANDOM MODE, causing the gain to be compressed from unity to -80 dB in approximately 0.5 seconds or less. In SINE MODE, under control of the DC $\propto$ FREQ, the amplifier is caused to compress the drive signal by 80 dB in approximately 1 second at 10 Hz, or in approximately 0.1 second or less at 100 Hz, etc.

An output from the K1 relay driver logic is applied to the K2 relay driver. A fixed time delay circuit prevents K2 from being actuated for approximately 0.5 second after K1 is actuated.

* When operating in SINE MODE, either an externally applied DC $\propto$ FREQ control voltage can be used, or it can be generated internally as a function of the SYSTEM TUNING IN frequency at J6. If an external DC $\propto$ FREQ source is used (2 mV/Hz linear), it is applied to J6; in this case, the A.C./D.C. switch S7 is set to D.C. If a source of DC $\propto$ FREQ is not available, S7 is set to A.C. Then the frequency-to-dc-converter card (A4) senses the frequency of the SYSTEM TUNING IN applied to J6 and produces a proportional d-c voltage at approximately 2 mV per Hz.

When either the MODE BYPASS or TURN ON push button is depressed, the associated front-panel indicator is connected to a lamp driver and flashes approximately once every second. The common lamp driver is pulsed by the output of a 1-Hz free-running multivibrator (both are located on the logic card). In the OPER MODE, power is removed from the multivibrator and lamp driver circuit.

Power supply card A6, supplied by power transformer T1, provides all d-c operating voltages (+20V and -20V). The 115/230 switch connects the T1 primary windings in parallel for 115V operation or in series for 230V operation.

Both the -20V and +20V supplies use conventional solid-state diode rectification and electronic voltage regulation circuitry. However, note that the +20V supply is caused to track the -20V supply; that is, although opposite in polarity, both the -20V and +20V are always equal in amplitude. Both outputs are current limited making them short circuit proof.

*Revised (9-15-72)

SECTION IV

CALIBRATION AND MAINTENANCE

4.1 GENERAL

Before calibrating the instrument, the technician is advised to study carefully Section III of this manual. Refer also to the front-panel and rear-chassis descriptions given in Section I.

Most voltage checks and adjustments can be made with the circuit cards installed. Remove and extend cards only when directed, and then use caution when installing extender and circuit card; be sure to remove power. Figure 4-1 is a top view of the instrument with cover removed, showing the calibration controls.

Note that except for the extender card, each circuit card is individually keyed to its receptacle. Each card is slotted, and a "key" is located between two pins of each receptacle. The extender card is slotted between all pins, and therefore can be used to extend any card without removing the "key".

Throughout the calibration procedure, calibration controls and parts on a circuit card are referenced by their circuit card and part number alphanumeric designator. For example, on Power Supply circuit card A5, R24 is referred to as A5R24. Similarly, circuit card pin connections are referenced by the circuit card alphanumeric designator, a hyphen, pin number/letter; such as A2-F or A4-16.

4.2 CALIBRATION PROCEDURE

CAUTIONS

1) To ensure proper calibration of the instrument, the following procedure must be performed in its entirety and in the sequence listed.

2) Be sure power is off before removing or replacing circuit cards.

3) Unless otherwise directed, do not extend circuit cards during calibration.

Table 4-1 lists the test equipment required; test equipment having equal or better operational characteristics may be substituted.

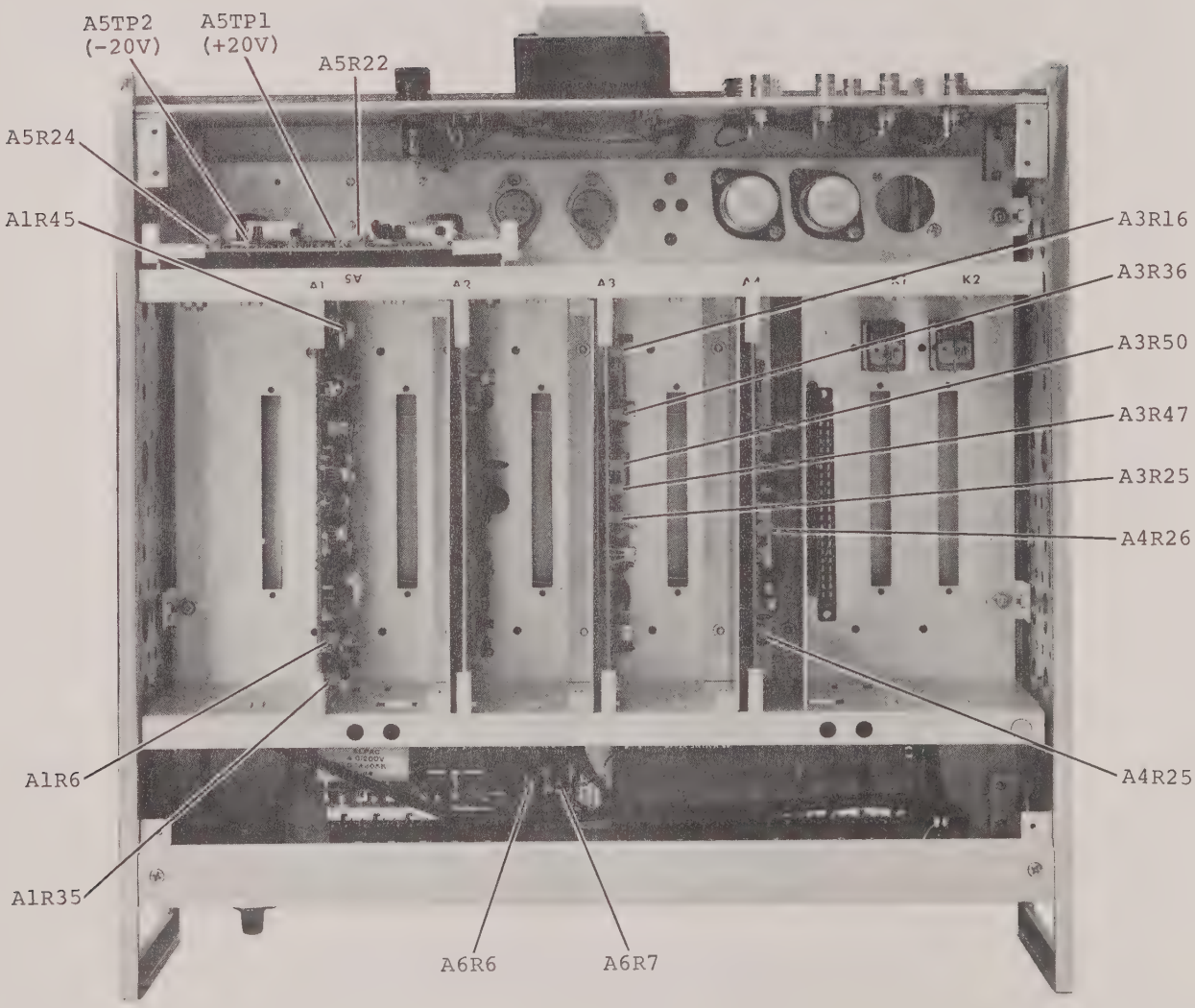
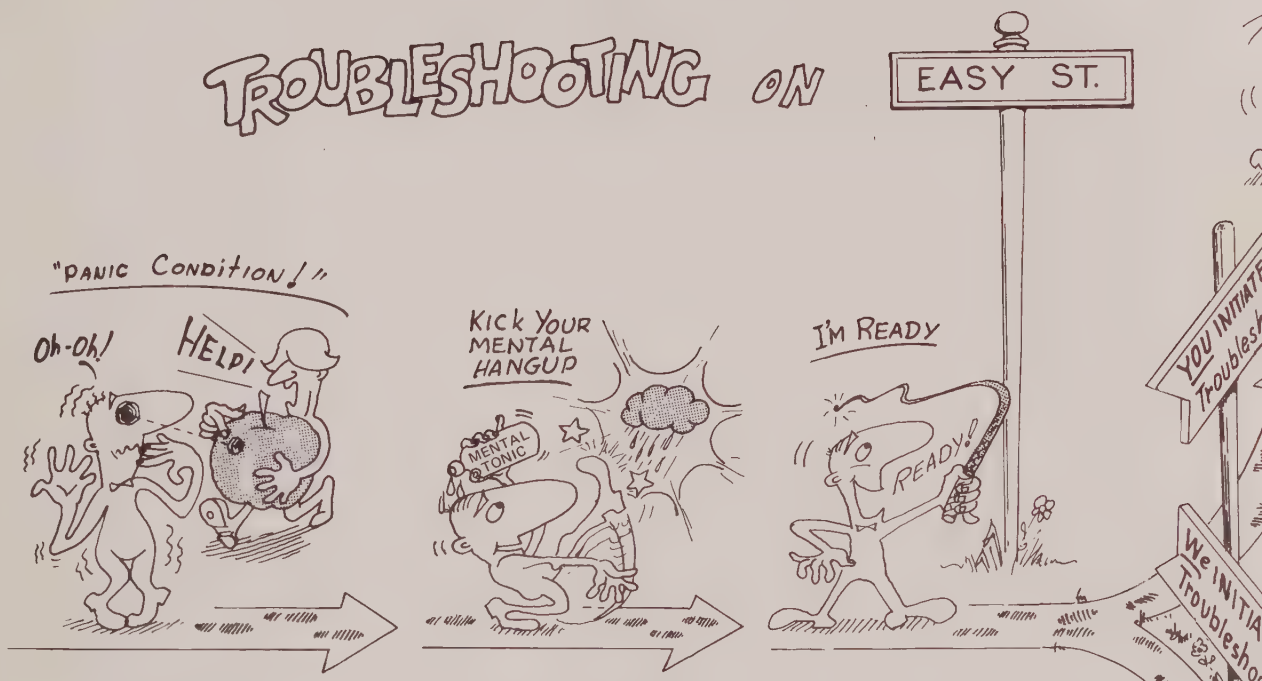


Figure 4-1. Chassis Top View — Calibration Controls

TROUBLESHOOTING ON EASY ST.



PANIC THOUGHTS

- I've never seen this one before!
- Does anybody know how it happened?
- They probably need it fixed yesterday!
- Who can I ask for help?

POSITIVE APPROACH

- Problem is probably simple.
- I can fix this problem easily.
- I am going to think logically.
- I am going to carefully evaluate the front panel indications.
- I'll talk to the person who had the problem.

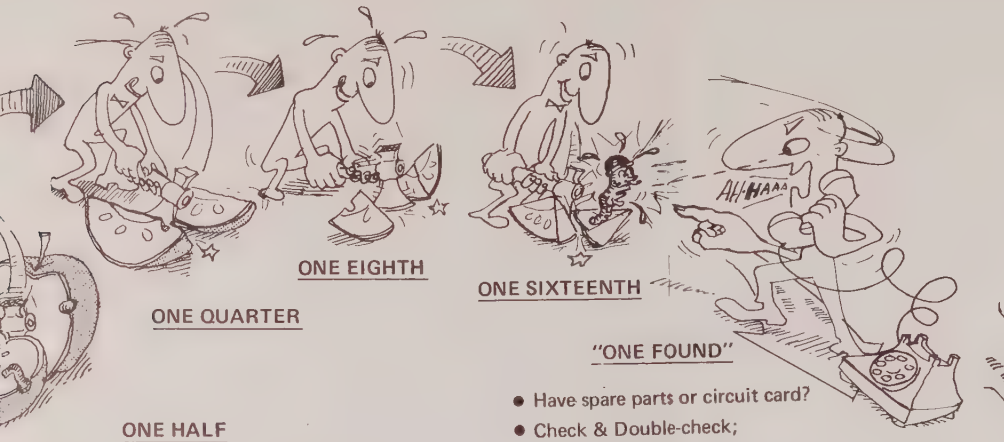
READY

- I can whip the problem NOW.

PREPARAT

- Have talke experience
- Have read
- Have comp Numbers f

SUCCESSIVE HALF-SPLIT TROUBLESHOOTING METHOD



ONE HALF

- Evaluate front panel symptoms before removing cover.
- Look for obvious—simple problem.
- Do not adjust to "FIX" problems!

ONE QUARTER

ONE EIGHTH

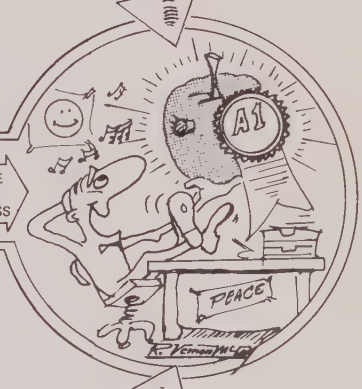
ONE SIXTEENTH

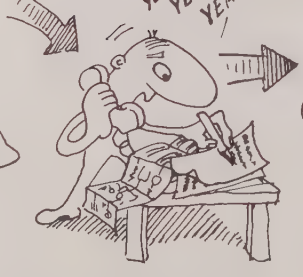
"ONE FOUND"

- Have spare parts or circuit card?
- Check & Double-check; then order parts.
- Prepare for call:
  Have correct part number from part or schematic.
  Have complete Model and Serial Numbers from rear of chassis.

The SDC
Customer Service Team
is
At Your Service
Aiming To Please

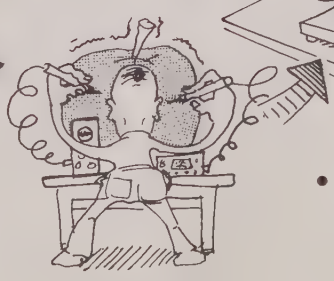
SERVICE IS OUR BUSINESS





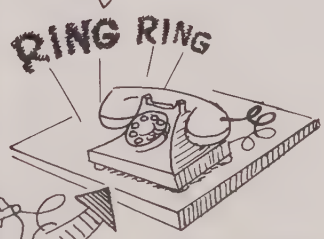
YOU CALL FOR INSTRUCTIONS

- We spell out tests.



YOU PERFORM CHECKOUT

- As instructed



WE CALL BACK

- To Check & Double-check

Table 4-1. Test Equipment Required.

Name	Model No.	Manufacturer
Digital Voltmeter	3440A	Hewlett-Packard
Frequency Counter	5223L	Hewlett-Packard
RMS Voltmeter	3400A	Hewlett-Packard
Volt Ohmmeter (Do not use A Tripplet)	269	Simpson
Oscillator	4200	Krohnhite
Oscilloscope	545	Tektronix
Probe	013-071	Tektronix
Distortion Analyzer	332A	Hewlett-Packard

4.2.1 Preliminary Setup

a. Check that the 115/230 switch on rear chassis is set properly, and the correct value of fuse is installed.

b. Remove top cover and check that all circuit cards are firmly seated in their receptacles.

c. Press 6 dB OVER TEST, 6 dB UNDER TEST, RANDOM, OPER, and RESET.

d. Connect power cord to the primary power source. Front-panel POWER indicator should glow red indicating power is on. Allow a 10-minute warmup.

4.2.2 Power Supply (A5)

a. Connect DVM and oscilloscope to A5TP2. Adjust A5R24 for -20V (-19.99V to -20.01V). Ripple should be less than 2 mV p-p.

b. Connect DVM and oscilloscope to A5TP1. Adjust A5R22 for +20V (+19.99V to +20.01V). Ripple should be less than 2 mV p-p.

4.2.3 Amplifier/Rectifier (A1)

a. Remove power, extend circuit card A1, and re-apply power.

b. Set g(RMS) duo-dial control to read 10 (10 in window, 0 on dial). Press MULTIPLIER 1 push button.

c. With DVM, check for -2 Vdc (-3.5 to -0.5V) at Pin 6 of integrated circuit A1A2, and at Pin 6 of A1A6. (If either voltage is out of tolerance, replace the associated 726C.)

d. With DVM at A1TP2, check for 0 Vdc (-0.005 to +0.005); adjust A1R35 if necessary.

*e. Connect ohmmeter between A1TP6 (negative lead) and A1TP9 (positive lead). Reading should be 1 megohm (950k to 1.05M). Adjust A1R45, if necessary, for proper photocell resistance. Leave ohmmeter connected.

f. Place rear-chassis switch S7 to D.C. Press SINE mode push button.

g. Apply +10 Vdc (9.9 to 10.1V) to J6.

h. Ohmmeter should read 14k ohms (11k to 17k). (If out of tolerance, select new value for A1R41, typically 49.9k ohms.) Disconnect the +10V at J6.

i. Press RANDOM mode push button.

j. At J1, ACCEL IN, apply 100 mV rms (97 mV to 103 Mv) sine wave at approximately 1 kHz.

k. With DVM at A1TP10, check for 537 mVdc (532 mV to 542 mV). Adjust A1R6 as necessary for proper voltage.

Leave circuit card A1 on the extender for the next check.

4.2.4 Upper Switch (A6)

a. Press RANDOM mode and ALP-SD117 push button.

*Be sure that the "positive" ohmmeter connection is actually the positive meter source.
CAUTION! DO NOT USE A TRIPPLET

b. At J8, ALP IN, apply 6.03 mV rms (5.83 mV to 6.23 mV) sine wave at approximately 1 kHz. (Preferably, use normalized output from ALP-SD117.)

c. Connect DVM to A1TP10 on Amplifier/Rectifier circuit card A1.

d. DVM should read 537 mVdc (532 mV to 542 mV). If necessary, adjust A6R7 for proper reading.

e. Press ALP-SD115 push button; change input at J8 to 354 mV rms (344 mV to 364 mV). (Preferably, use normalized output from ALP-SD115.)

f. DVM reading at A1TP10 should be 537 mVdc (532 mV to 544 mV). If necessary, adjust A6R6 for proper reading.

g. Remove DVM at A1TP10, but leave test oscillator at J8.

h. Remove power, return circuit card A1 to its receptacle, and re-apply power.

4.2.5 Logic (A2)

a. Press BYPASS mode push button; observe that the red BYPASS indicator flashes at approximately 1-second intervals.

b. Press TURN ON mode push button; observe amber TURN ON indicator flashes at approximately 1-second intervals.

c. Move test oscillator from J8 to J1. Adjust input at J1 to 100 mV rms (97 mV to 103 mV). Press MULTIPLIER 1 and OPER push buttons.

d. Press 1 dB OVER TEST and then RESET push buttons; only POWER indicator should be lit.

e. Slowly increase input at J1 until OVER TEST indicator lights. Input should be 1 dB ±0.5 dB above 100 mV rms input.

f. In sequence, press each dB OVER TEST push button (1.5, 2, 2.5, etc.), then RESET, and increase the input until the OVER TEST indicator lights. In each case, the input should equal (±0.5 dB) the dB OVER TEST push button value.

g. Adjust input at J1 to 100 mV rms (97 mV to 103 mV).

h. Press 1 dB UNDER TEST and RESET push buttons; only POWER indicator should be lit.

i. Slowly decrease input at J1 until UNDER TEST indicator lights. Input should be -1 dB ±0.5 dB below 100 mV rms.

j. In sequence, press each dB UNDER TEST push button, then RESET, and decrease input at J1 until UNDER TEST indicator lights. In each case, the input should equal (±0.5 dB) the dB UNDER TEST push button (negative) value.

4.2.6 AGC Amplifier (A3)

a. Remove power, extend circuit card A3, and re-apply power.

b. At J1, adjust level to 150 mV rms (145 mV to 155 mV). Press 6 dB OVER TEST, 6 dB UNDER TEST, RANDOM mode, and RESET.

*c. Connect ohmmeter between A3TP1 (negative lead) and A3TP2 (positive lead). Reading should be 1 megohm (950k to 1.05M); adjust A3R25 as necessary for proper reading. Leave ohmmeter connected.

d. At J6, apply 10 Vdc (9.9V to 10.1V) and ensure S7 is set to D.C. Press SINE mode push button.

e. Ohmmeter should read 4,000 ohms (3,800 to 4,200 ohms). Adjust A3R47 as necessary for proper reading. Remove ohmmeter.

f. Connect oscilloscope to A3TP9. Press 1 dB OVER TEST and note shift in d-c level. Note this level as the zero reference.

*Refer to footnote on page 4-4.

NOTE

If a transient occurs on OVER TEST it will be reduced later in Step h.

g. Press 6 dB OVER TEST, then RESET, and note level; it should be within ±5 mVdc of that noted in Step f. If not, adjust A3R36 until d-c shift is balanced to within ±5 mVdc.

h. If a transient occurs at the time of OVER TEST (or UNDER TEST), reduce it by adjusting A3R50; then re-adjust A3R36 as necessary to reduce d-c shift at A3TP9 to less than ±5 mVdc. Repeat these two adjustments until both conditions are met.

NOTE

A transient of up to 100 mV may be present when RESET is pressed; this is acceptable.

i. Remove the +10 Vdc from J6.

j. Apply 10 Vrms (9.5V to 10.5V) to J2. (See Figure 2-1 and note common source for both J1 and J2, using an attenuator.) Maintain input of 150 mV rms at J1.

k. Press RANDOM, 6 dB OVER TEST, and then RESET.

l. Connect oscilloscope to A3TP7 and note level. Check for same level within ±3% at A3TP8; adjust A3R16 as necessary. (Leave input connected for next steps.)

m. Use distortion analyzer and check signal distortion level at A3TP9; the total harmonic distortion should be less than 0.5%. Remove distortion analyzer.

n. Connect oscilloscope to A3TP9 and observe 10 Vrms signal level. Now initiate an OVER TEST by pressing the 1 dB OVER TEST push button. Observe that the signal level is compressed by approximately 80 dB in 0.4 to 0.8 second. (Leave oscilloscope on A3TP9.)

o. Apply +2 Vdc (1.9V to 2.1V) to J6; S7 in D.C. position. Press SINE mode, +6 dB OVER TEST, and then RESET.

p. Trigger the oscilloscope on the negative-going step of the signal at A3TP3 when an OVER TEST occurs.

q. Initiate an OVER TEST by pressing the 1 dB OVER TEST push button and observe that compression occurs in 0.007 to 0.015 second.

r. Disconnect +2 Vdc from J6.

s. Remove power, return circuit card A3 to its receptacle, extend circuit card A4, and re-apply power.

4.2.7 Frequency to D.C. (A4)

a. Set S7 to A.C. To J6 apply 5 kHz (4,950 Hz to 5,050 Hz) sine wave at 1 Vrms (0.9V to 1.1V).

b. Connect DVM to A4TP7. DVM should read +10 Vdc (9.9V to 10.1V). Adjust A4R26 as necessary.

c. Change input frequency at J6 to 10 Hz (9.5 Hz to 10.5 Hz). DVM at A4TP7 should read +20 mVdc (18 mV to 22 mV); adjust A4R25 as necessary. (Some ripple may be present at 10 Hz.)

To verify the overall operation of the instrument, perform the Operational Checkout Procedure of Paragraph 2.3 in Section II of this manual.

4.3 PARTS REPLACEMENT

Except for some special SDC specification-controlled parts that are listed in Table 4-2, which must be ordered from Spectral Dynamics Corporation, standard electronic parts have been used throughout the instrument. Spectral Dynamics Corporation maintains a complete stock of all parts and complete printed circuit card assemblies used in this instrument.

When ordering a replacement part or assembly, be sure to include the reference designation, the part number or manufacturers' designation, and a complete description; include also the instrument name, model number, and serial number.

Table 4-2. Special Replaceable Parts List

Reference Designator	Description	Part Number/ Mfr. Designation
A1	Circuit Card, Amplifier/Rectifier	14194-1
A2	Circuit Card, Logic	14190-1
A3	Circuit Card, AGC Amplifier	14196-1
A4	Circuit Card, Frequency to D.C.	14200-1
A5	Circuit Card, Power Supply	14188-1
A6	Circuit Card, Upper Switch	14202-1
A7	Circuit Card, Lower Switch	14206-1
	Circuit Card, Extender	23060-1
DS1,3,4,5	Lamp, POWER, BYPASS, OVER TEST, UNDER TEST	CF03-RTS-2102
DS2	Lamp, TURN ON	CF03-ACS-2102
P4	Plug, AUX FUNCTIONS	GK-12-21C-1/2
P5	Plug, INTERLOCK	GK-9-21C-1/2
T1	Power Transformer	20013-246
	Knob, Push Button	20013-360-4
	Power Cord	17258-S (Belden)

Table 4-2. Special Replaceable Parts List (Cont'd)

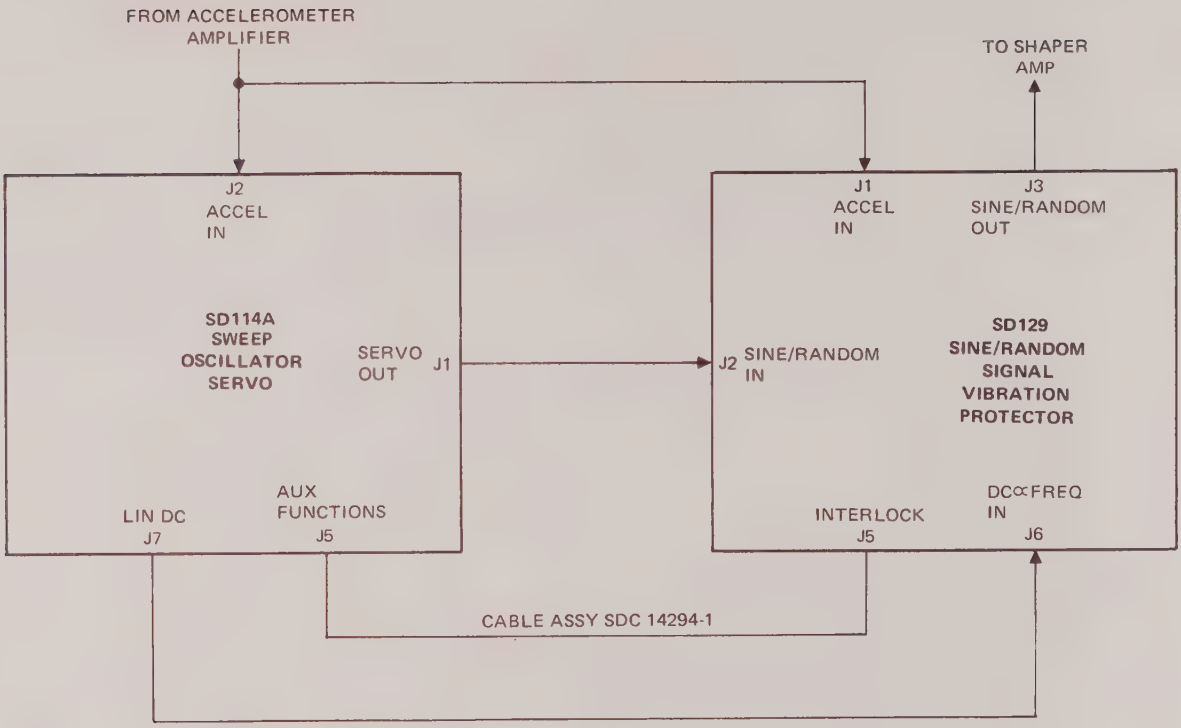
Reference Designator	Description	Part Number/ Mfr. Designation
	Lamp, Photo Cell Assembly	20013-134
A6S1	Switch, Push Button Assembly	20013-436
A6S2	Switch, Push Button Assembly	20013-437
A7S3	Switch, Push Button Assembly	20013-417
A7S4	Switch, Push Button Assembly	20013-435
A7S5	Switch, Push Button Assembly	20013-437

APPENDIX A

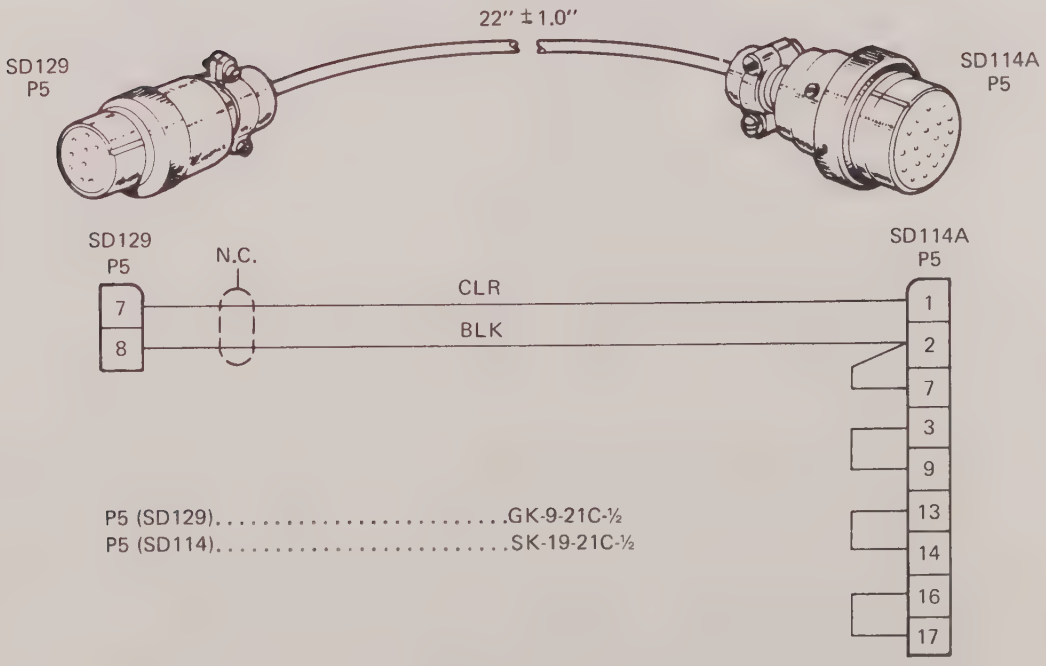
INTERCONNECT CABLE DIAGRAMS

Table of Contents

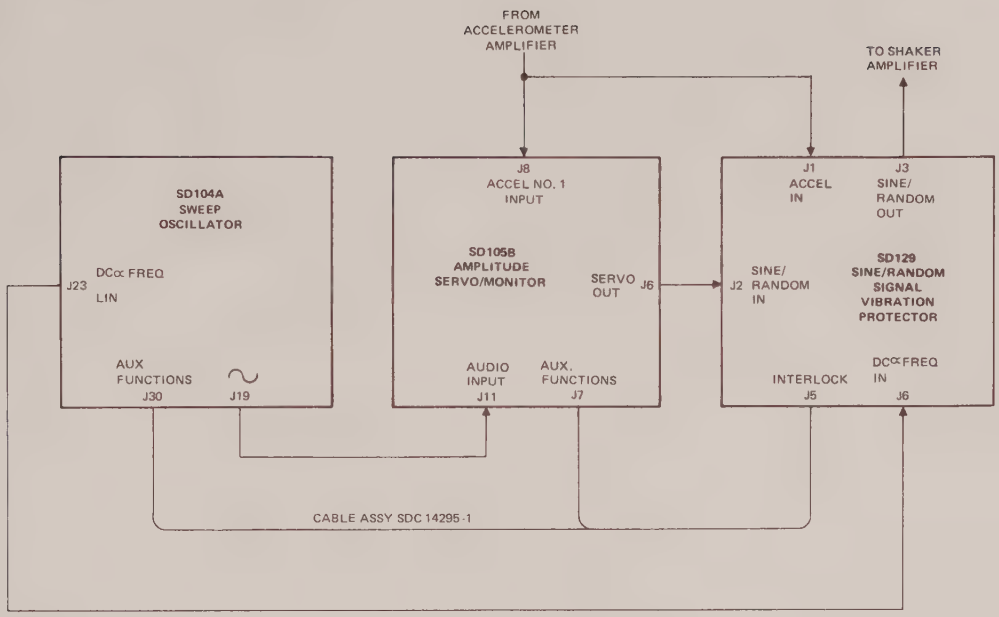
Description	Page
Interconnect Diagram – SD129/SD114A	
Cable Assembly 14294-1	A2
Interconnect Diagram – SD129/SD104A/SD105B	
Cable Assembly 14295-1	A3
Interconnect Diagram – SD129/SD114A/SD117A	
Cable Assembly 15233-1	A4
Interconnect Diagram – SD129/SD104A/SD105B/SD115A	
Cable Assembly 14293-1	A5



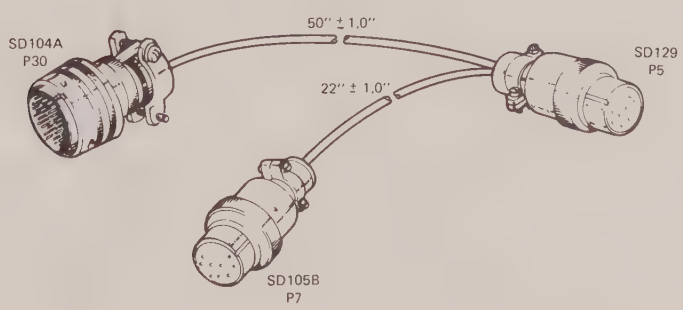
Interconnect Diagram — SD129/SD114A

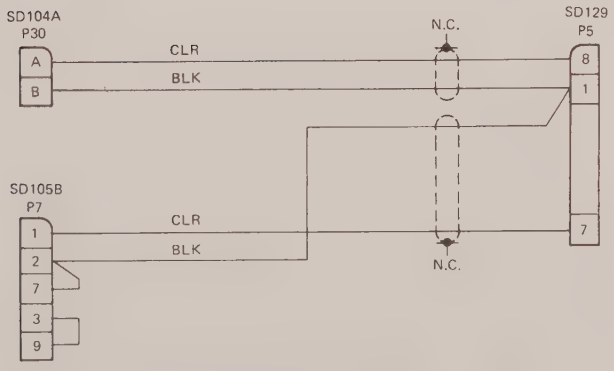


Cable Assembly 14294-1



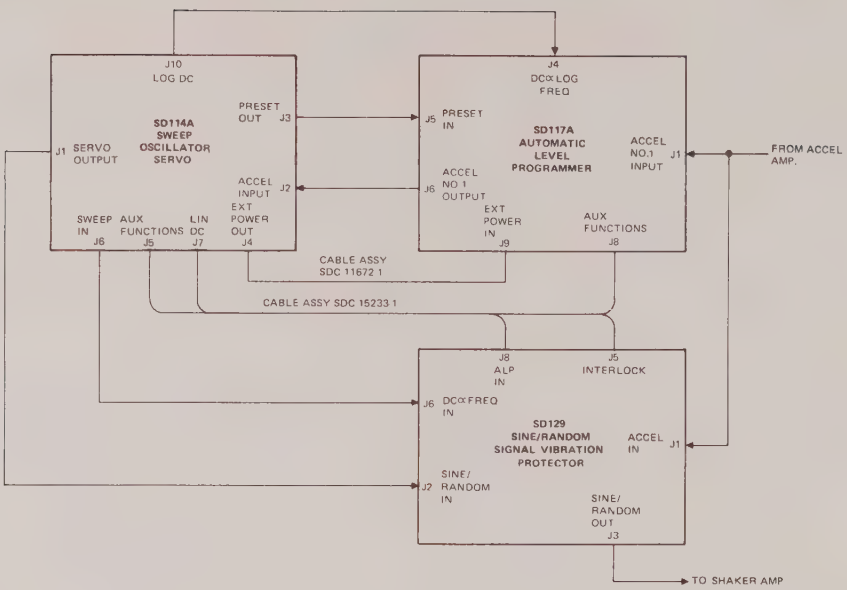
Interconnect Diagram — SD129/SD104A/SD105B



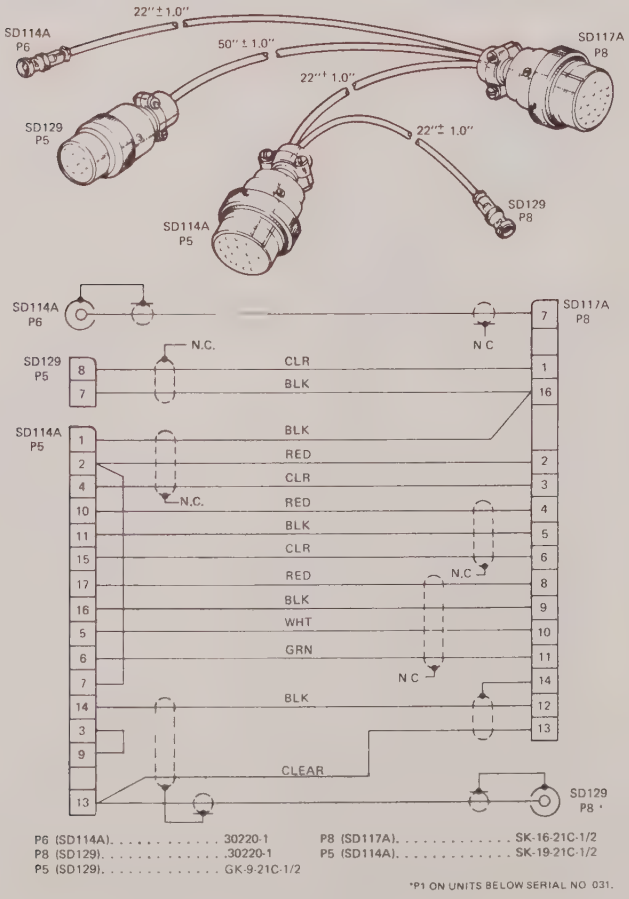


P30 (SD104A)..... PTO6E-16-26P (SR)
P5 (SD129)..... GK-9-21C-½
P7 (SD105B)..... GK-9-21C-½

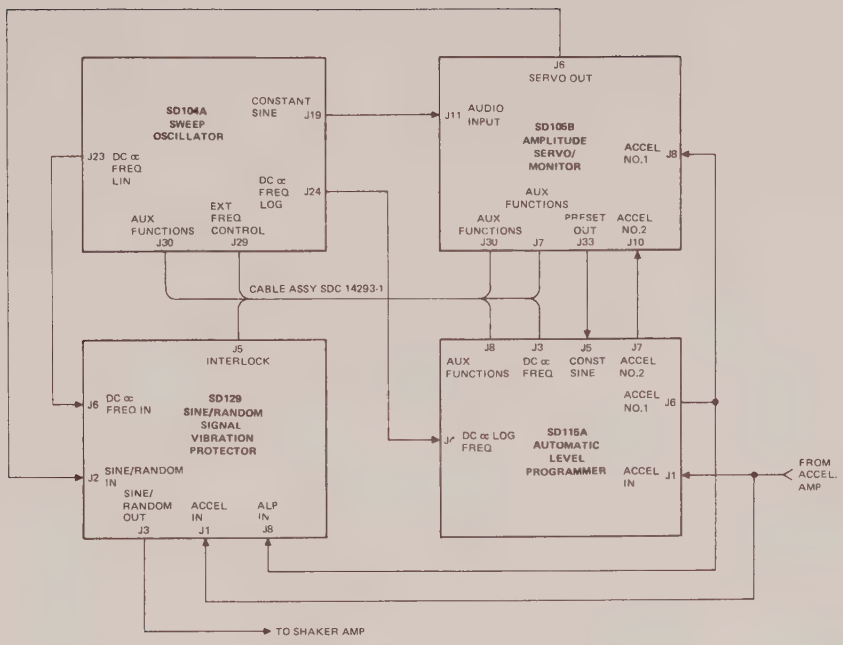
Cable Assembly 14295-1



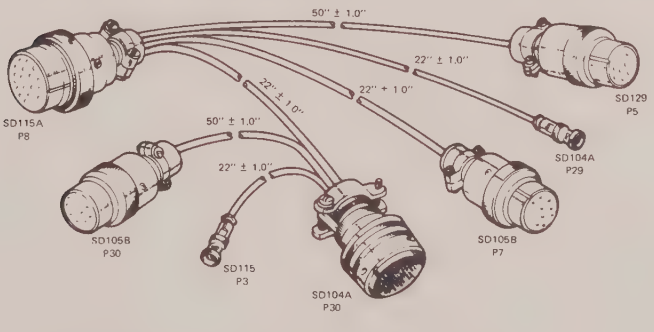
Interconnect Diagram — SD129/SD114A/SD117A

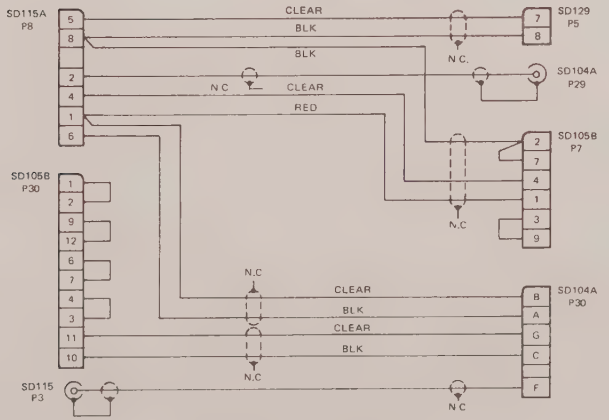


Cable Assembly 15233-1



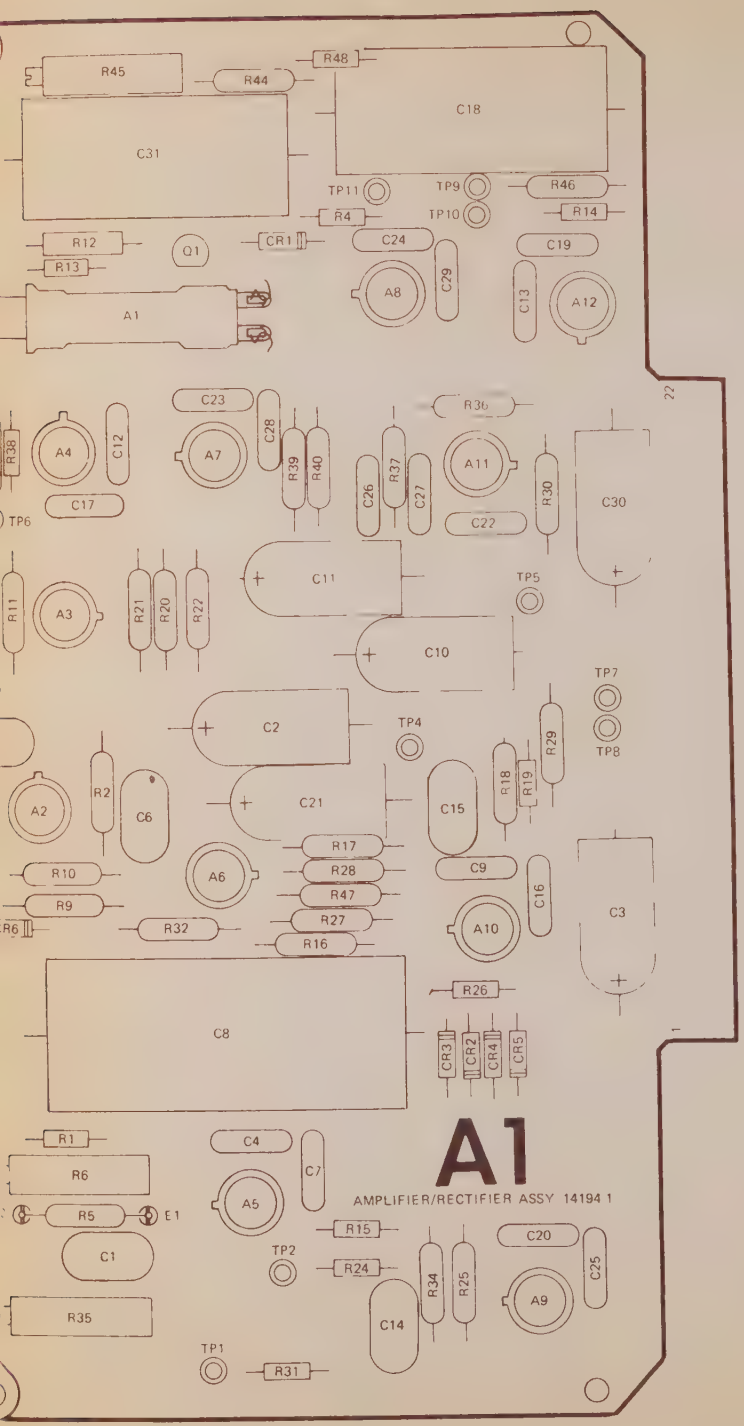
Interconnect Diagram — SD129/SD104A/SD105B/SD115A





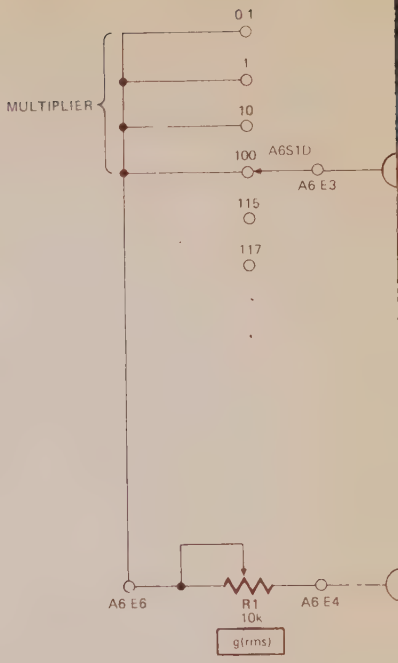
P8 (SD115A) SK-19-21C-½
P30 (SD105B) GK-12-21C-½
P3 (SD115) 30220-1
P30 (SD104A) . . . . . PT 06E-16-2P (SR)
P7 (SD105B) GK-9-21C-½
P29 (SD104A) 30220-1
P5 (SD129) GK-9-21C-½

Cable Assembly 14293-1

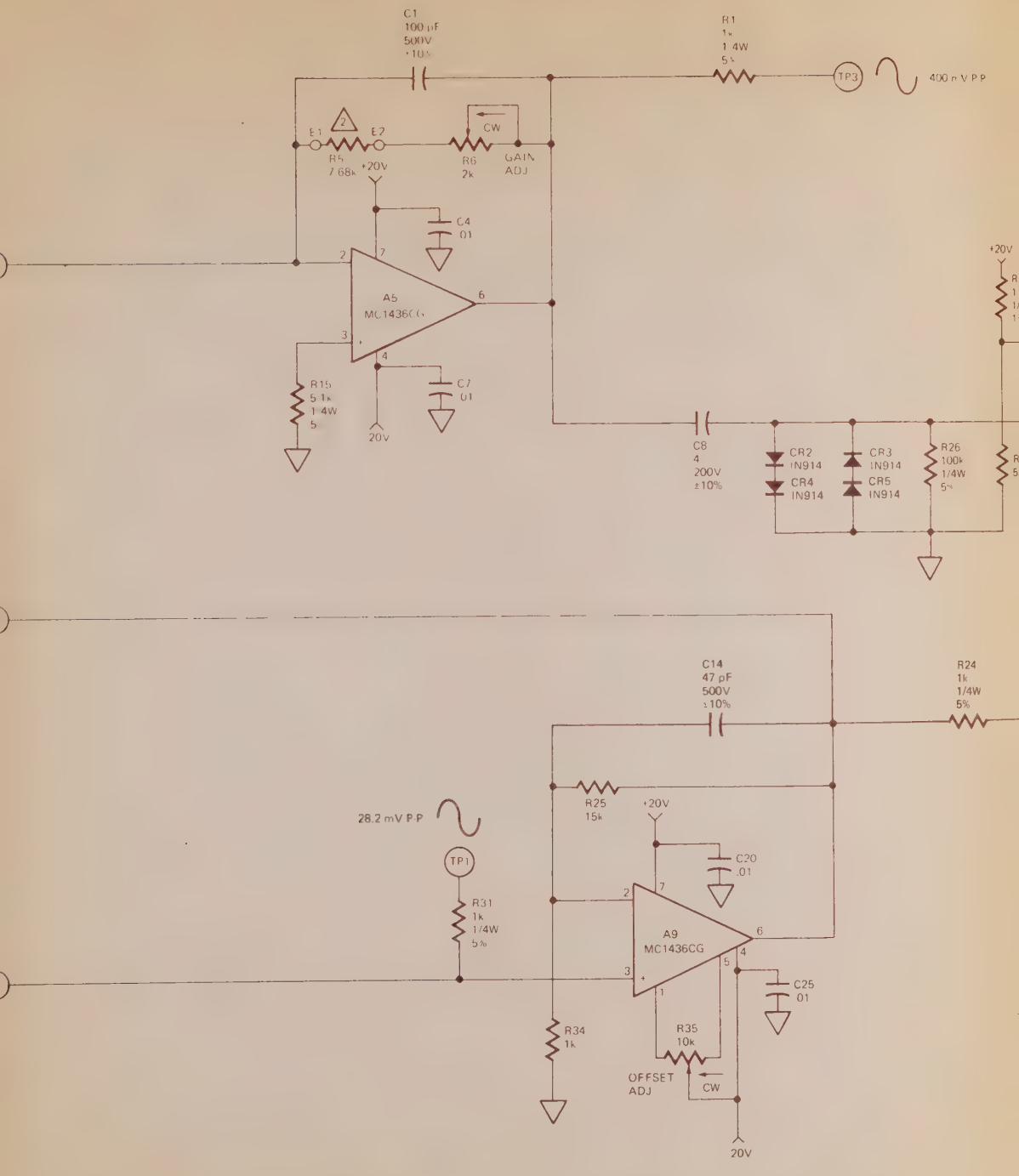


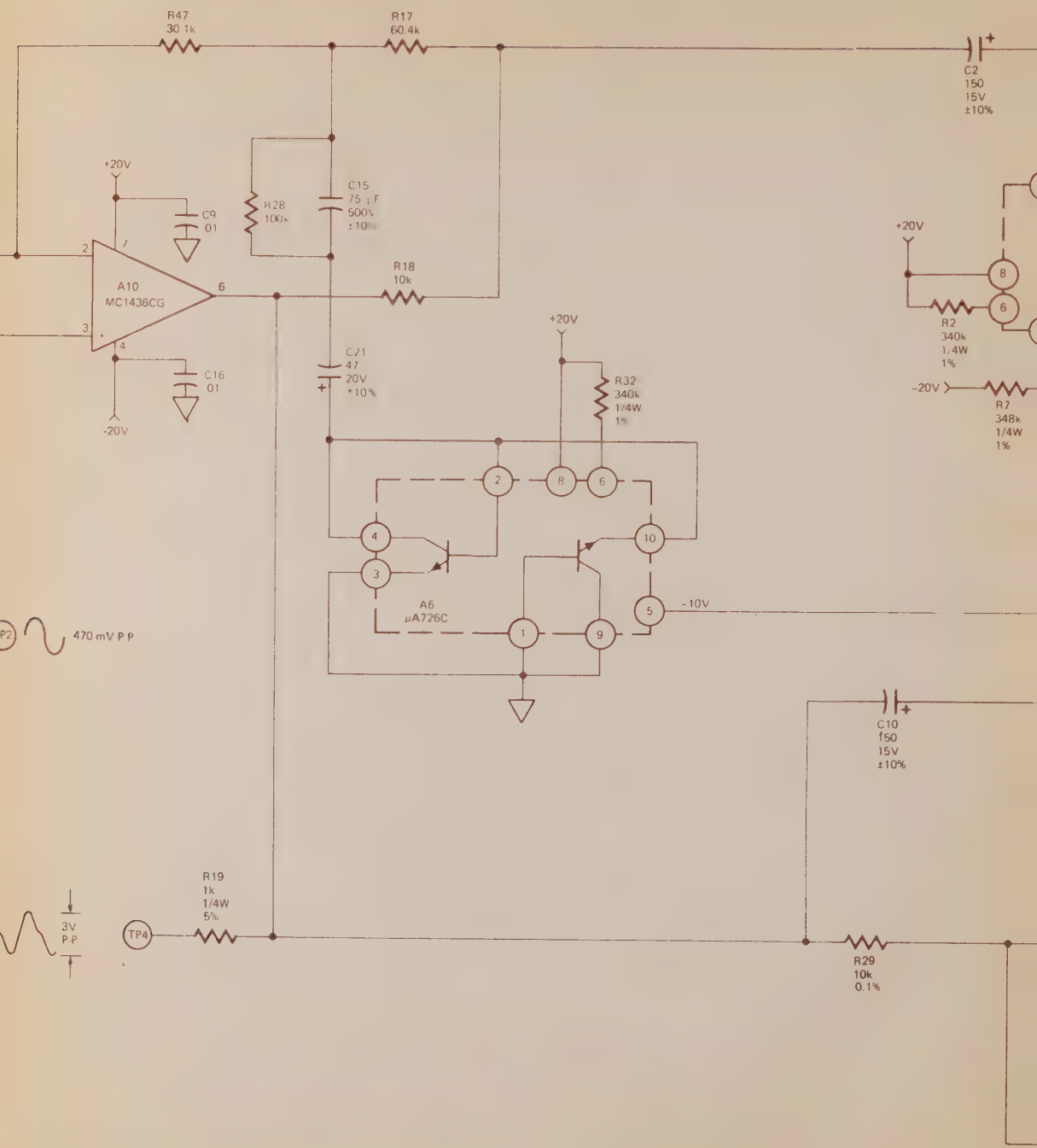
A1

AMPLIFIER/RECTIFIER ASSY 14194 1

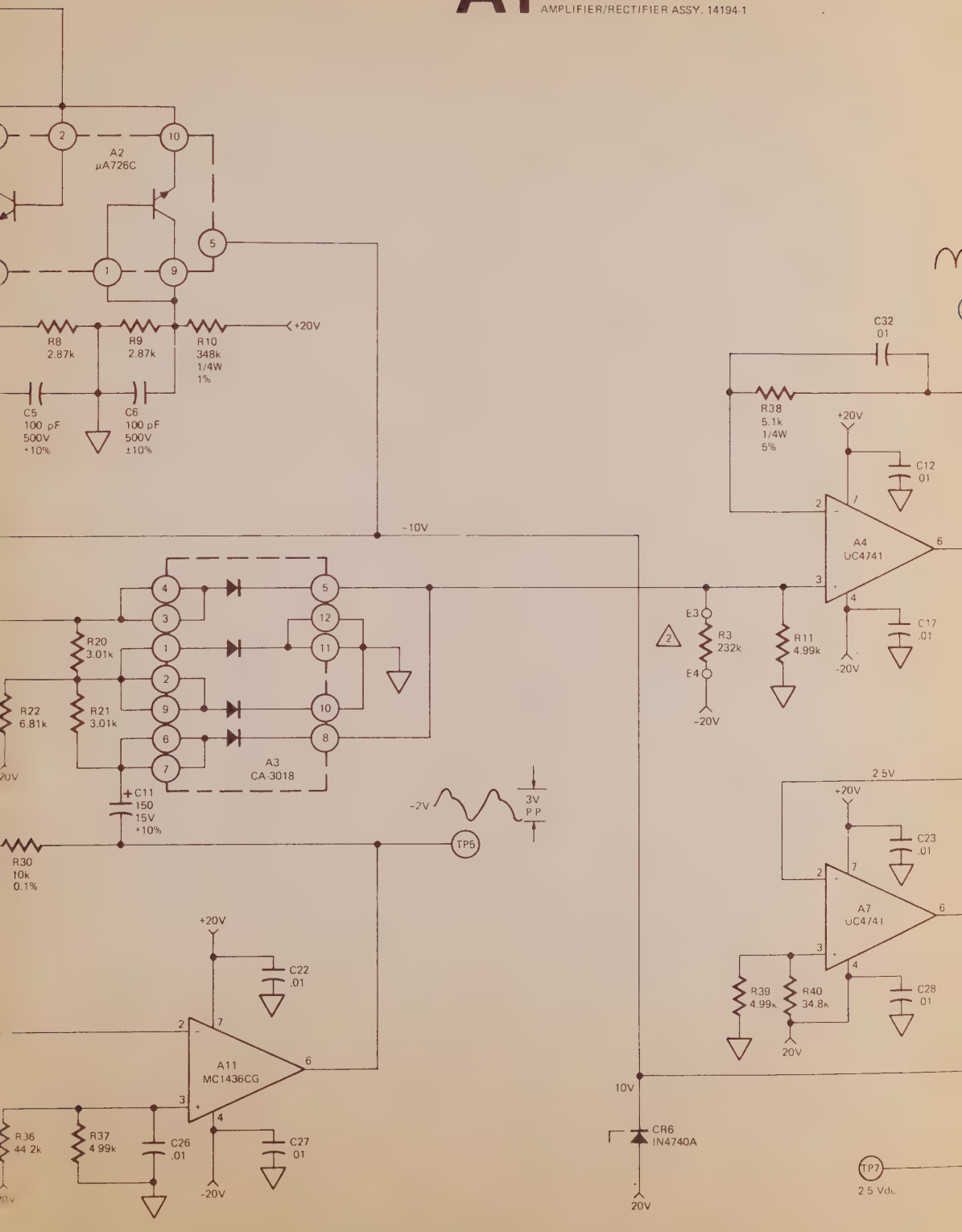


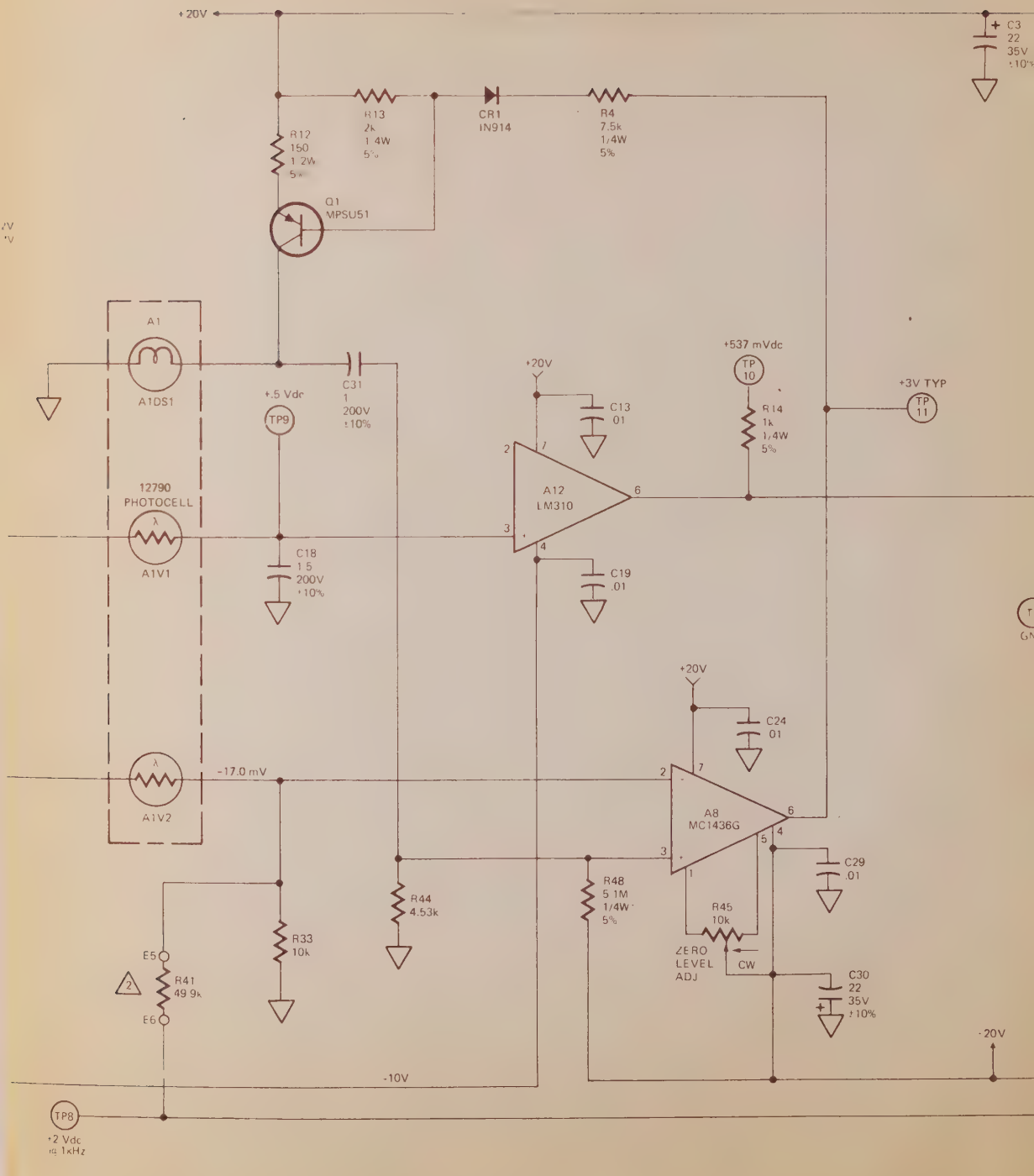
ACCEL IN
VIA S1B
FROM
A6 E5


C1
100 pF
500V
±10%
R1
1k
1 4W
5%
TP3
400 m V P P
E1
E2
R5
7 68k
+20V
CW
R6
2k
GAIN
ADJ
C4
01
A5
MC1436CG
R15
5 1k
1 4W
5
20V
C7
01
C8
4
200V
±10%
CR2
IN914
CR4
IN914
CR3
IN914
CR5
IN914
R26
100k
1/4W
5%
+20V
C14
47 pF
500V
±10%
R24
1k
1/4W
5%
R25
15k
+20V
28.2 mV P P
TP1
C20
.01
R31
1k
1/4W
5%
A9
MC1436CG
C25
01
R34
1k
R35
10k
OFFSET
ADJ
CW
20V

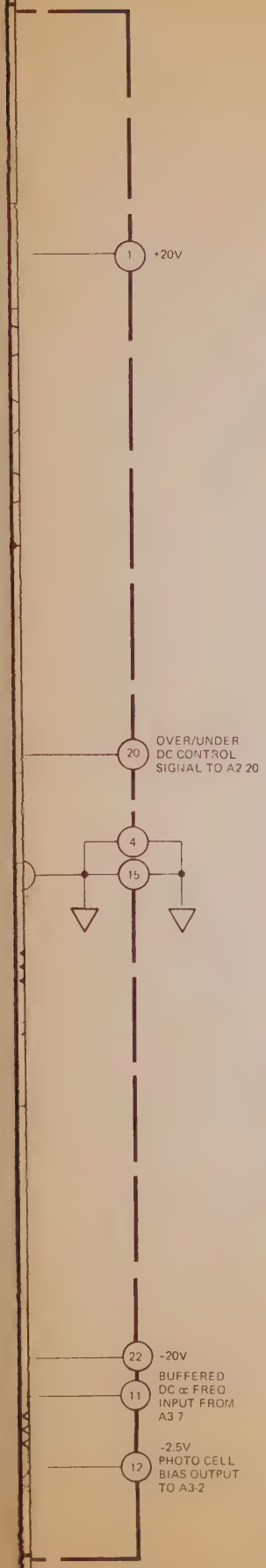

R47
30.1k
R17
60.4k
C2
150
15V
±10%
+20V
C9
01
R28
100k
C15
75 pF
500V
±10%
A10
MC1436CG
R18
10k
C16
01
-20V
C21
47
20V
+10%
+20V
R32
340k
1/4W
1%
A6
μA726C
-10V
470 mV P-P
C10
150
15V
±10%
+20V
R2
340k
1/4W
1%
-20V
R7
348k
1/4W
1%
R19
1k
1/4W
5%
TP4
3V
P-P
R29
10k
0.1%

A1 AMPLIFIER/RECTIFIER ASSY. 14194-1




+20V
C3
22
35V
±10%
R13
2k
1 4W
5%
CR1
IN914
R4
7.5k
1/4W
5%
R12
150
1 2W
5%
Q1
MPSU51
A1
A1DS1
+.5 Vdc
TP9
C31
1
200V
±10%
12790
PHOTOCELL
A1V1
C18
1.5
200V
±10%
+20V
C13
.01
A12
LM310
+537 mVdc
TP
10
R14
1k
1/4W
5%
+3V TYP
TP
11
C19
.01
-17.0 mV
A1V2
+20V
C24
01
A8
MC1436G
C29
.01
R48
5 1M
1/4W
5%
R45
10k
ZERO
LEVEL
ADJ
CW
C30
22
35V
±10%
R44
4.53k
R33
10k
E5
R41
49 9k
E6
-20V
-10V
TP8
+2 Vdc
@ 1kHz

REVISIONS						
REV	ECO	S/N	DESCRIPTION	DRAFT	CHECK	APPD
B		012	REDRAWN	L.S. 11-71		



NOTES: UNLESS OTHERWISE INDICATED:

1. ALL RESISTOR VALUES ARE IN OHMS, 1/8W, 1%.
   ALL CAPACITORS ARE IN MICROFARADS, 50V, +80 -20%

2. FACTORY SELECT WITH TYPICAL VALUE SHOWN

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SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO

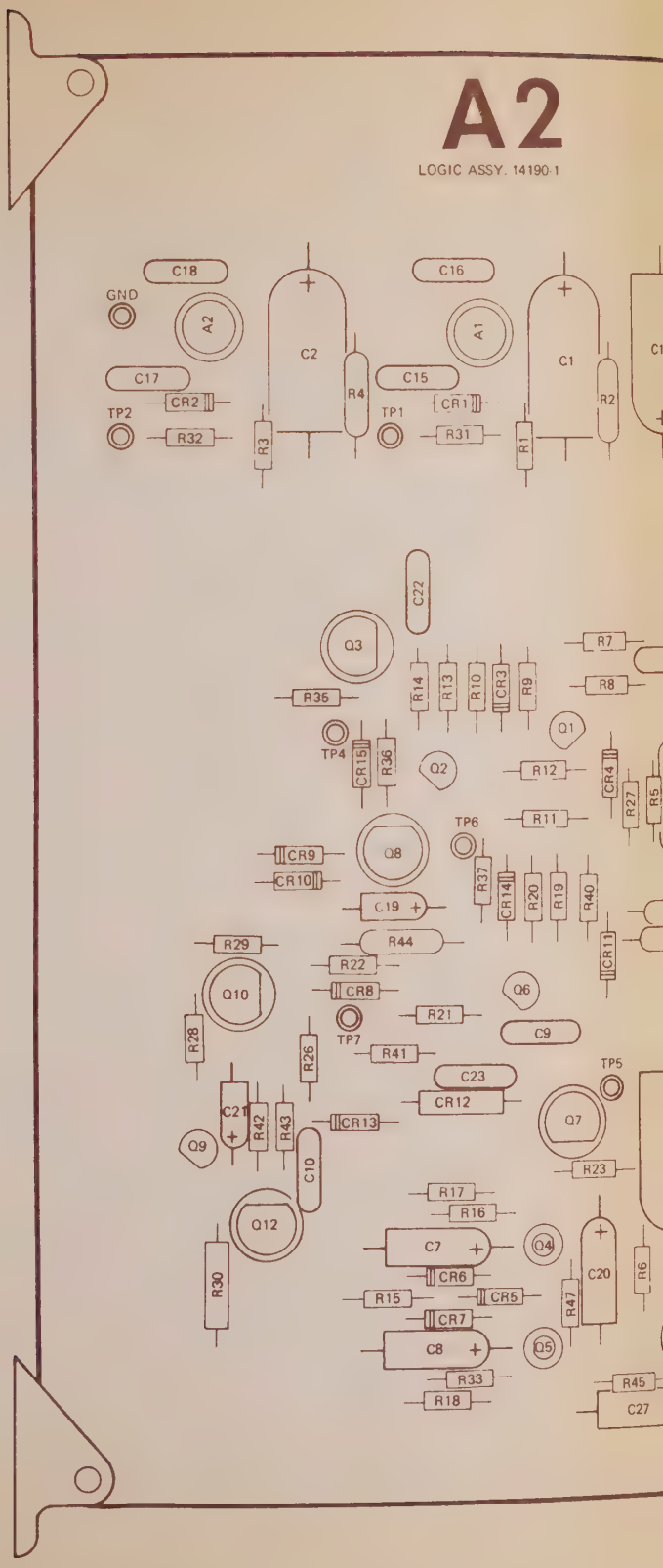
DRAWN	L. SAUER	11 71
DESIGNER		
CHECKED		11-11-71
ENGINEER		
APPROVED		11/15/71

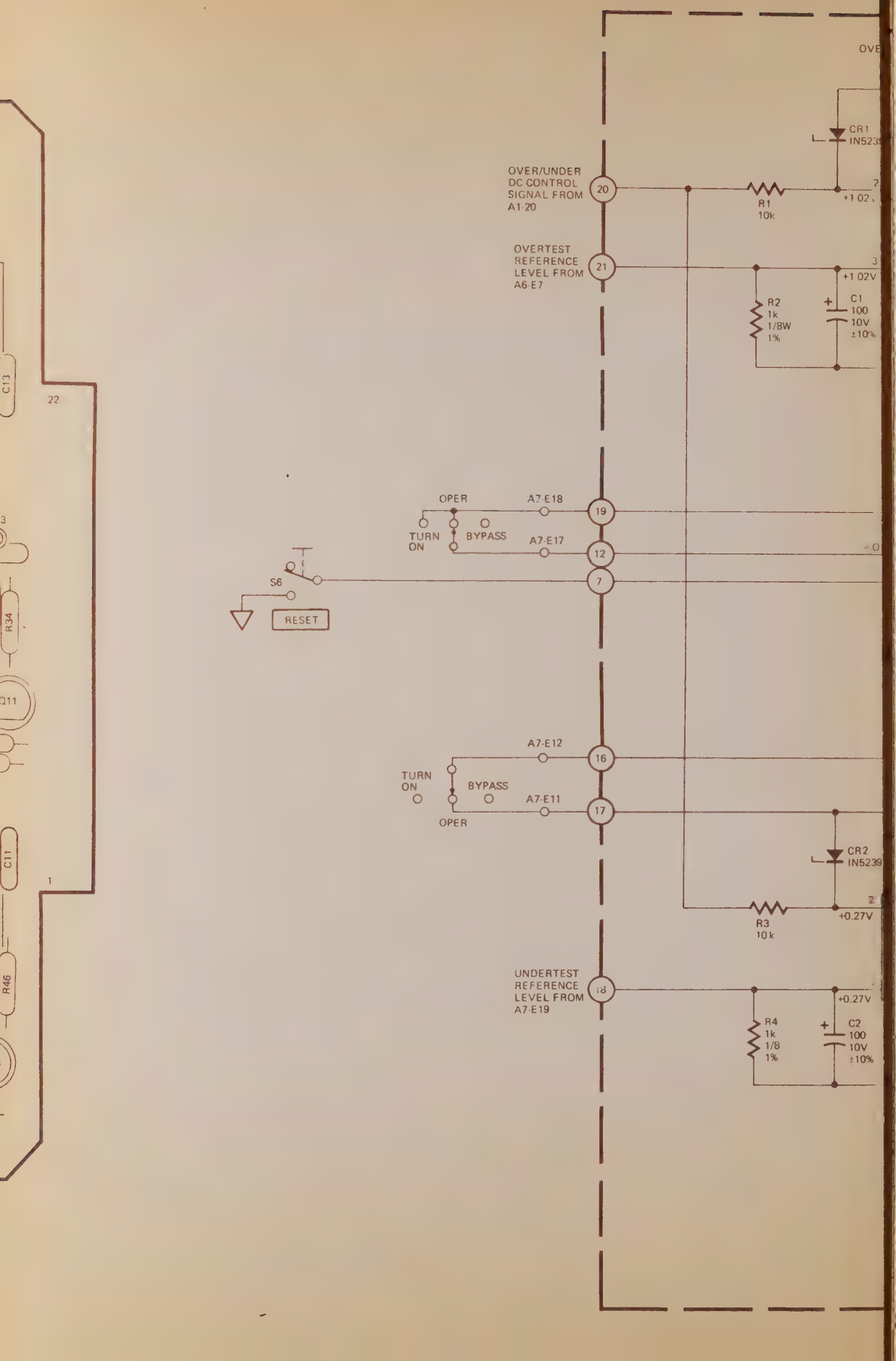
TITLE: SCHEMATIC/COMPONENT LAYOUT – AMPLIFIER/RECTIFIER ASSEMBLY 14194-1

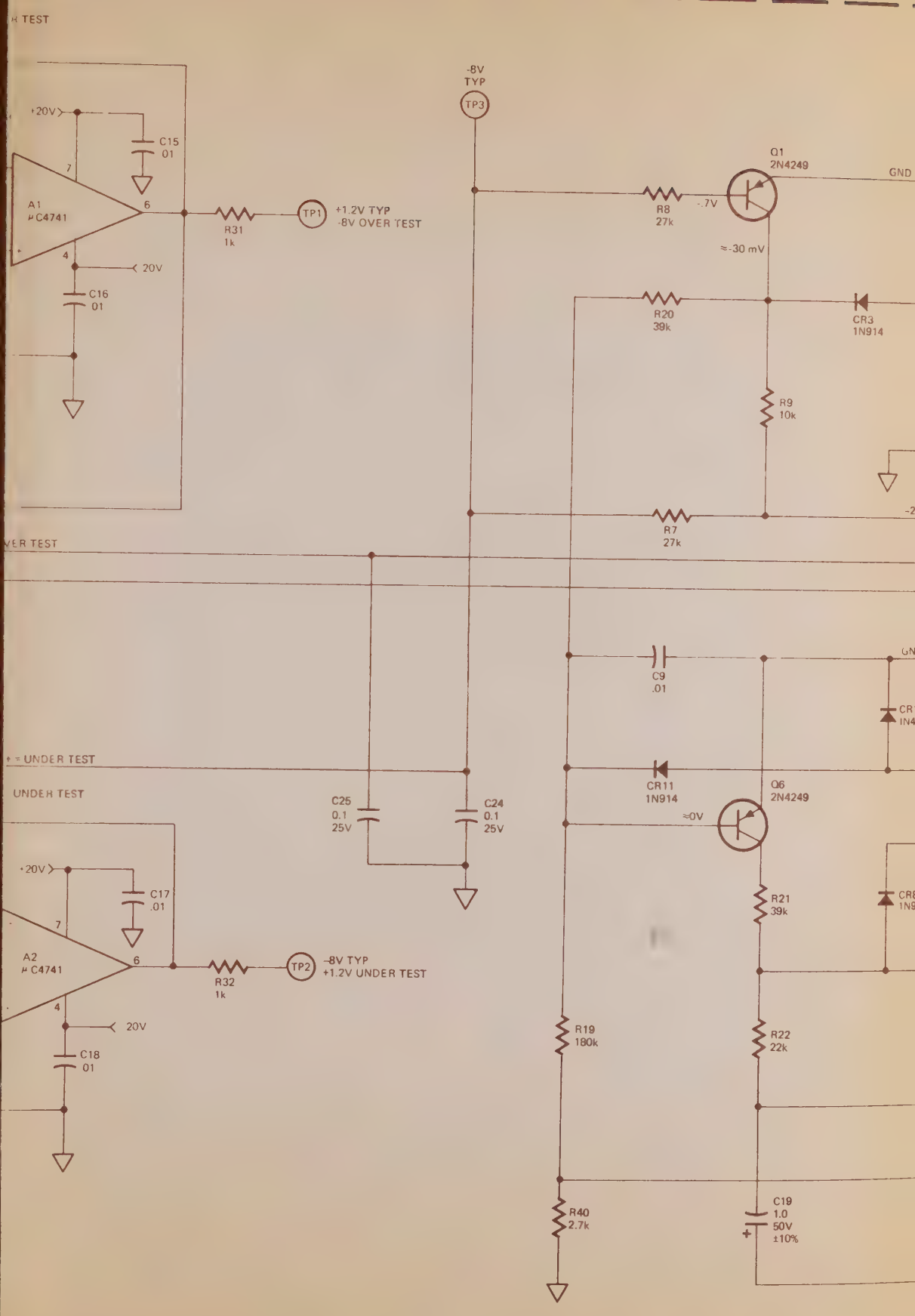
A1

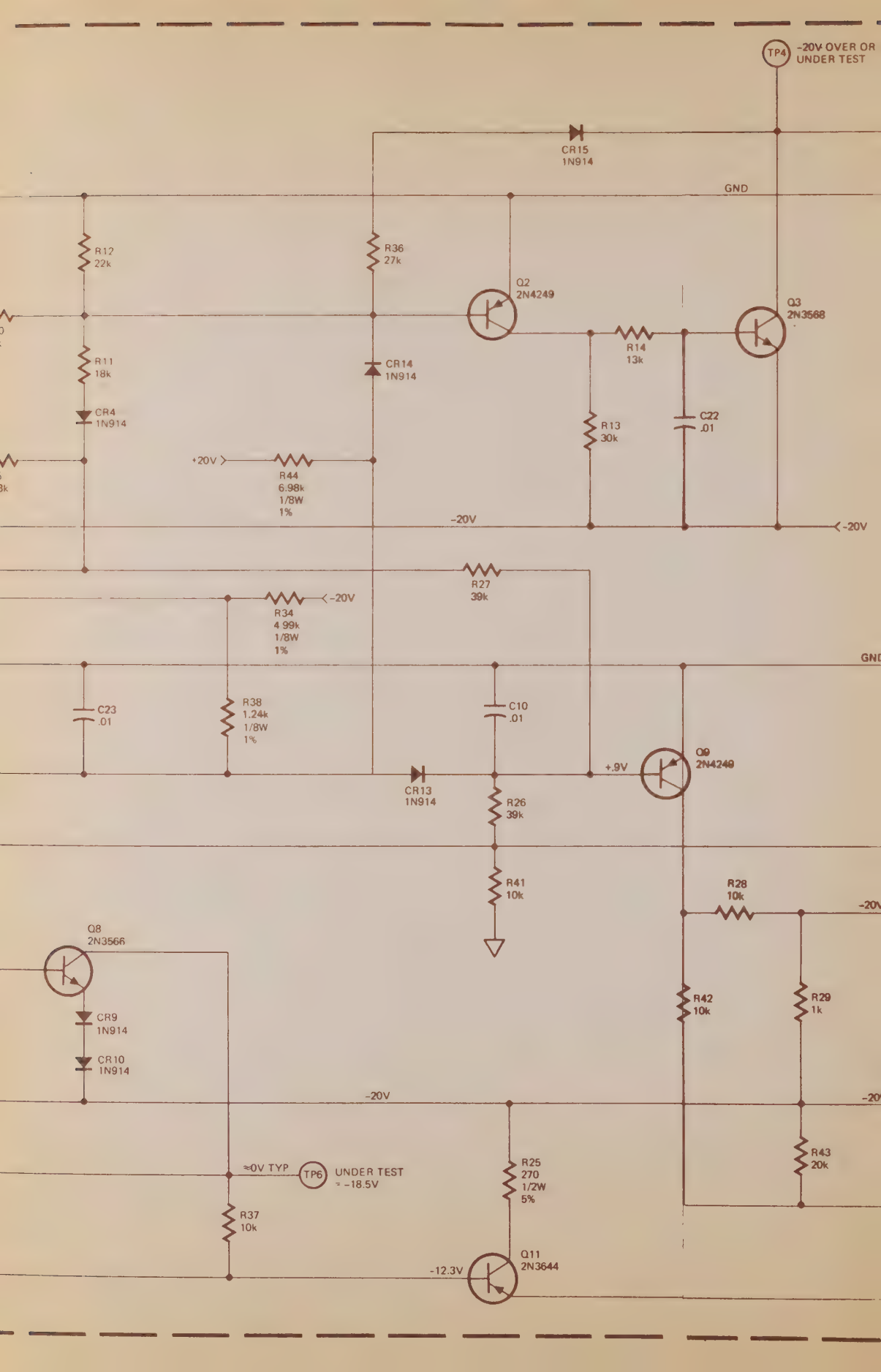
MODEL	SIZE	DRAWING NO.	REV
SD129		14192	B

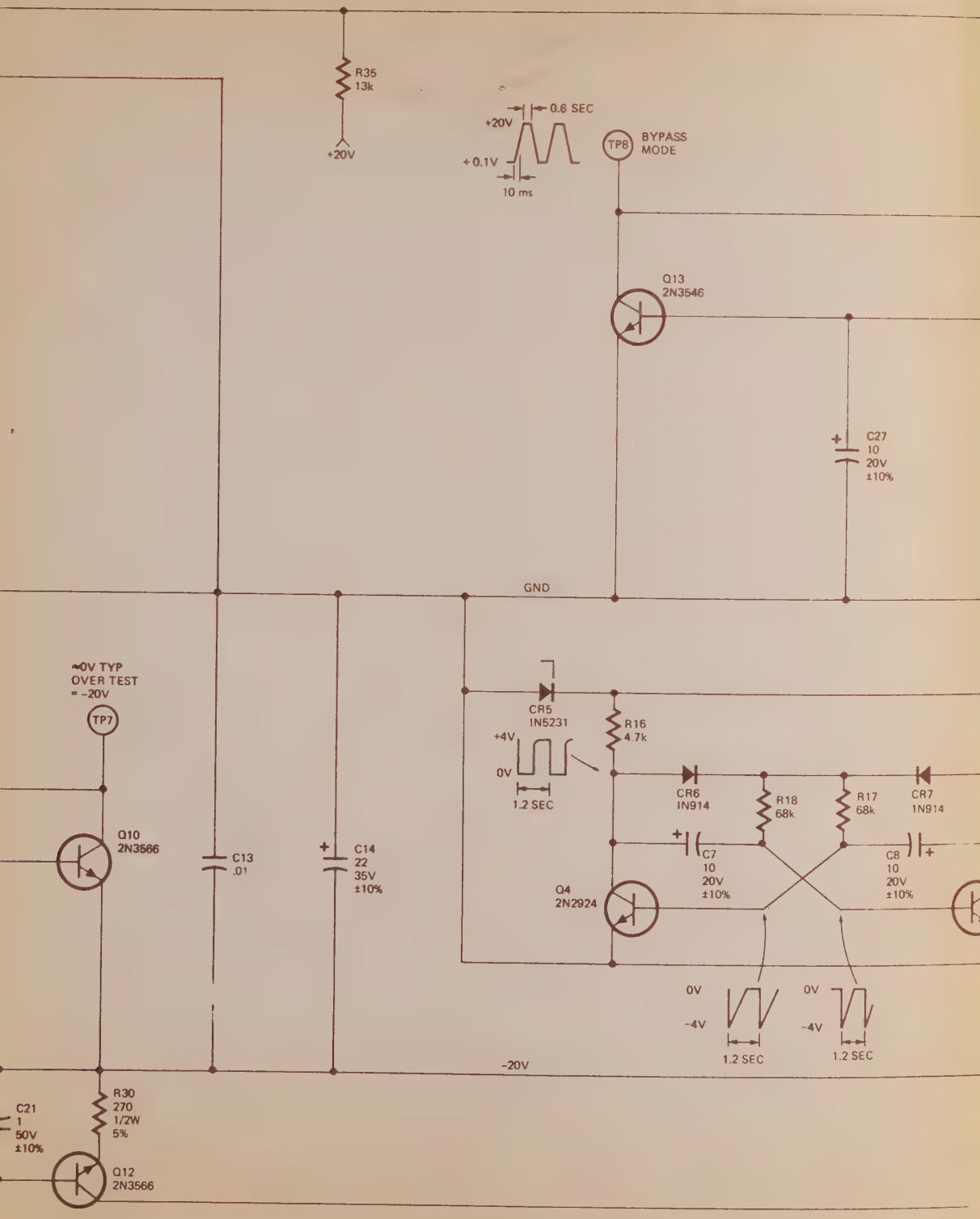
SCALE | SHEET 1 OF 1

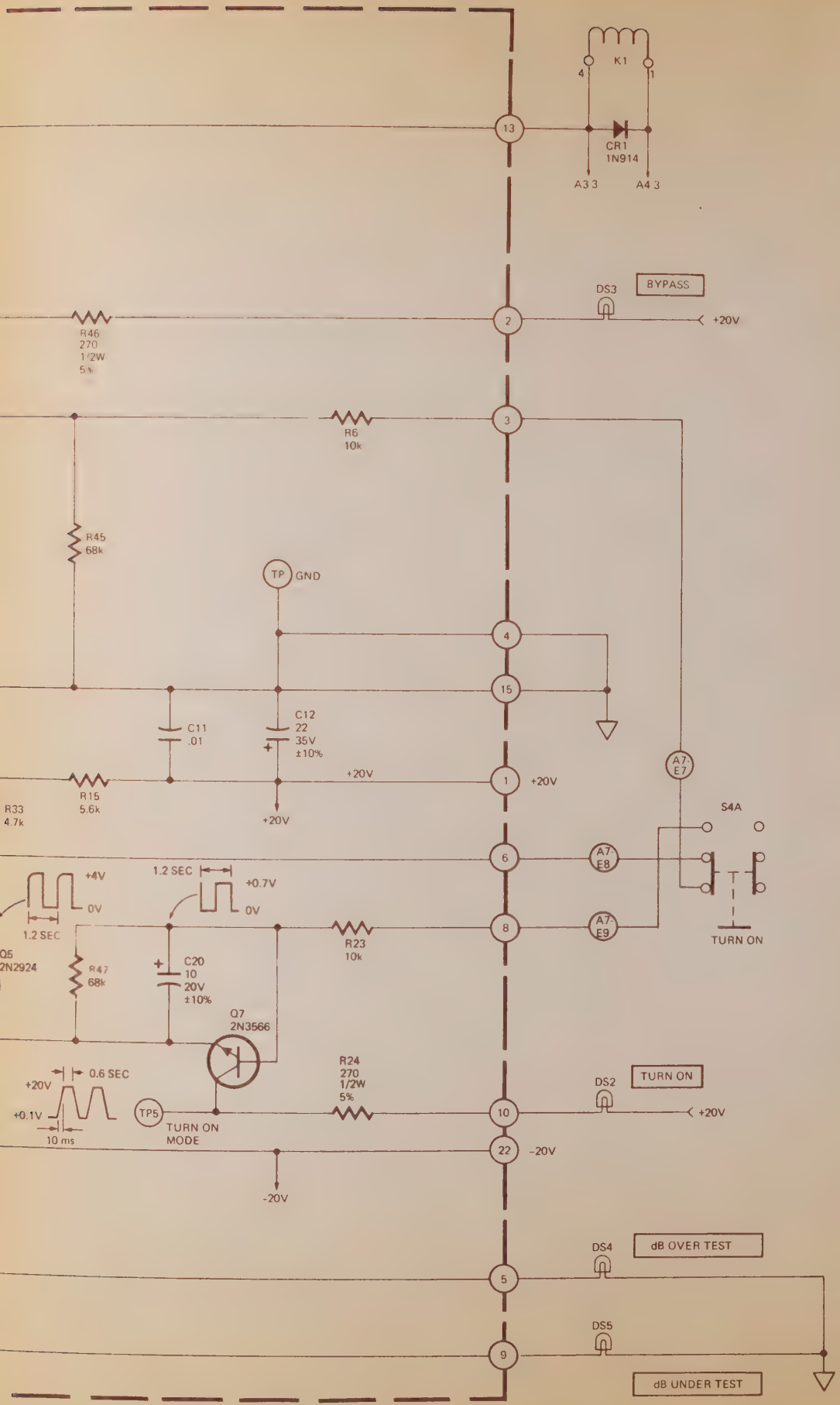

A2
LOGIC ASSY. 14190-1
C18
GND
A2
C17
CR2
TP2
R32
C2
R4
R3
C16
A1
C15
CR1
TP1
R31
C1
R2
R1
C22
Q3
R35
TP4
CR15
R36
R14
R13
R10
CR3
R9
R7
R8
Q1
Q2
R12
CR4
R27
R5
TP6
R11
CR9
CR10
Q8
C19
R37
CR14
R20
R19
R40
CR11
R29
R44
R22
CR8
Q10
R28
R26
TP7
R21
Q6
C9
R41
C23
CR12
TP5
Q7
C21
R42
R43
CR13
Q9
C10
R23
R17
R16
Q12
C7
Q4
C20
R6
R30
CR6
R15
CR5
CR7
R47
C8
Q5
R33
R18
R45
C27


OVE
CR1
IN523
OVER/UNDER
DC CONTROL
SIGNAL FROM
A1-20
20
R1
10k
+1 02
OVERTEST
REFERENCE
LEVEL FROM
A6-E7
21
+1 02V
R2
1k
1/8W
1%
C1
100
10V
±10%
OPER
A7-E18
19
TURN
ON
BYPASS
A7-E17
12
S6
7
RESET
A7-E12
16
TURN
ON
BYPASS
A7-E11
17
OPER
CR2
IN5239
R3
10 k
+0.27V
UNDERTEST
REFERENCE
LEVEL FROM
A7-E19
18
+0.27V
R4
1k
1/8
1%
C2
100
10V
±10%
C13
22
R34
C11
1
R46


TEST
+20V
C15
01
A1
μC4741
7
6
4
20V
C16
01
R31
1k
TP1
+1.2V TYP
-8V OVER TEST
-8V
TYP
TP3
Q1
2N4249
GND
R8
27k
-.7V
≈-30 mV
R20
39k
CR3
1N914
R9
10k
R7
27k
VER TEST
C9
.01
= UNDER TEST
UNDER TEST
CR11
1N914
Q6
2N4249
≈0V
C25
0.1
25V
C24
0.1
25V
+20V
C17
.01
A2
μC4741
R32
1k
TP2
-8V TYP
+1.2V UNDER TEST
20V
C18
01
R21
39k
R19
180k
R22
22k
R40
2.7k
C19
1.0
50V
±10%


TP4
-20V OVER OR UNDER TEST
CR15
1N914
GND
R12
22k
R36
27k
Q2
2N4249
Q3
2N3568
R11
18k
CR14
1N914
R14
13k
CR4
1N914
R13
30k
C22
.01
+20V
R44
6.98k
1/8W
1%
-20V
-20V
R27
39k
R34
4.99k
1/8W
1%
-20V
GND
C23
.01
R38
1.24k
1/8W
1%
C10
.01
Q9
2N4249
+9V
CR13
1N914
R26
39k
R41
10k
R28
10k
-20V
Q8
2N3566
R42
10k
R29
1k
CR9
1N914
CR10
1N914
-20V
-20V
R43
20k
≈0V TYP
TP6
UNDER TEST
= -18.5V
R25
270
1/2W
5%
R37
10k
Q11
2N3644
-12.3V


R35
13k
+20V
0.6 SEC
+20V
+0.1V
10 ms
TP8
BYPASS
MODE
Q13
2N3546
C27
10
20V
±10%
GND
≈0V TYP
OVER TEST
= −20V
TP7
CR5
IN5231
+4V
0V
1.2 SEC
R16
4.7k
CR6
IN914
R18
68k
R17
68k
CR7
1N914
C7
10
20V
±10%
C8
10
20V
±10%
Q4
2N2924
Q10
2N3566
C13
.01
C14
22
35V
±10%
0V
-4V
1.2 SEC
0V
-4V
1.2 SEC
-20V
C21
1
50V
±10%
R30
270
1/2W
5%
Q12
2N3566


K1
4
1
13
CR1
1N914
A3 3
A4 3
DS3
BYPASS
2
+20V
R46
270
1/2W
5%
3
R6
10k
R45
68k
TP
GND
4
15
C11
.01
C12
22
35V
±10%
+20V
1
+20V
A7
E7
S4A
R15
5.6k
R33
4.7k
+20V
6
A7
E8
+4V
0V
1.2 SEC
1.2 SEC
+0.7V
0V
8
A7
E9
R23
10k
TURN ON
Q5
2N2924
R47
68k
C20
10
20V
±10%
Q7
2N3566
0.6 SEC
+20V
+0.1V
10 ms
TP5
TURN ON
MODE
R24
270
1/2W
5%
DS2
TURN ON
10
+20V
22
-20V
-20V
DS4
dB OVER TEST
5
DS5
9
dB UNDER TEST

REVISIONS						
REV	ECO	S/N	DESCRIPTION	DRAFT	CHECK	APP'D
B	—	012	REDRAWN	D.S. 10 71		11/5/71

NOTES: UNLESS OTHERWISE INDICATED:

1. ALL RESISTOR VALUES ARE IN OHMS; 1/4W, 5%.
   ALL CAPACITOR VALUES ARE IN MICROFARADS; 50V, +80, -20%.
2. SYMBOL [ ] INDICATES FRONT PANEL LOCATION.

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SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO

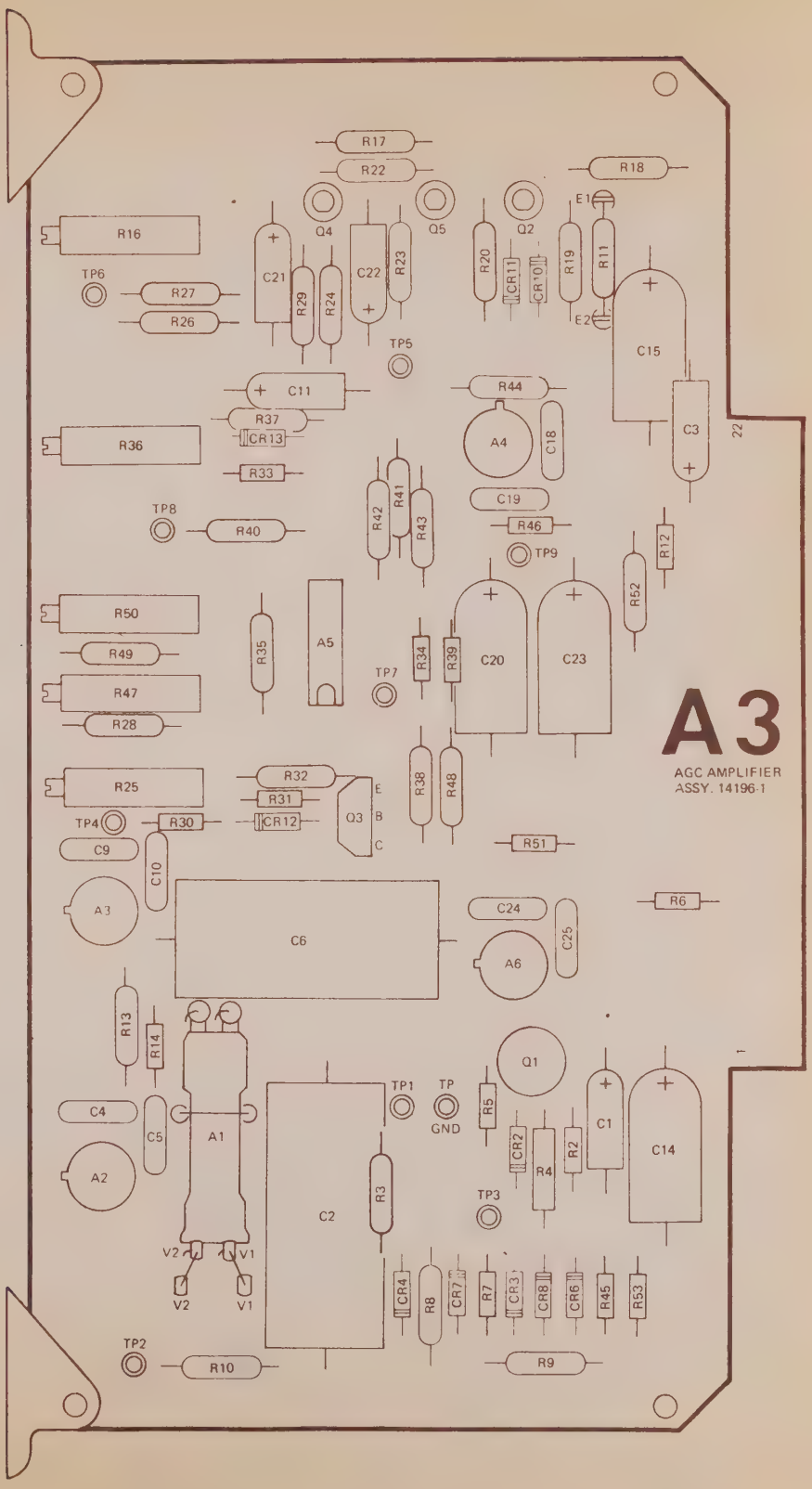
TITLE: SCHEMATIC/COMPONENT LAYOUT — LOGIC ASSEMBLY 14190-1

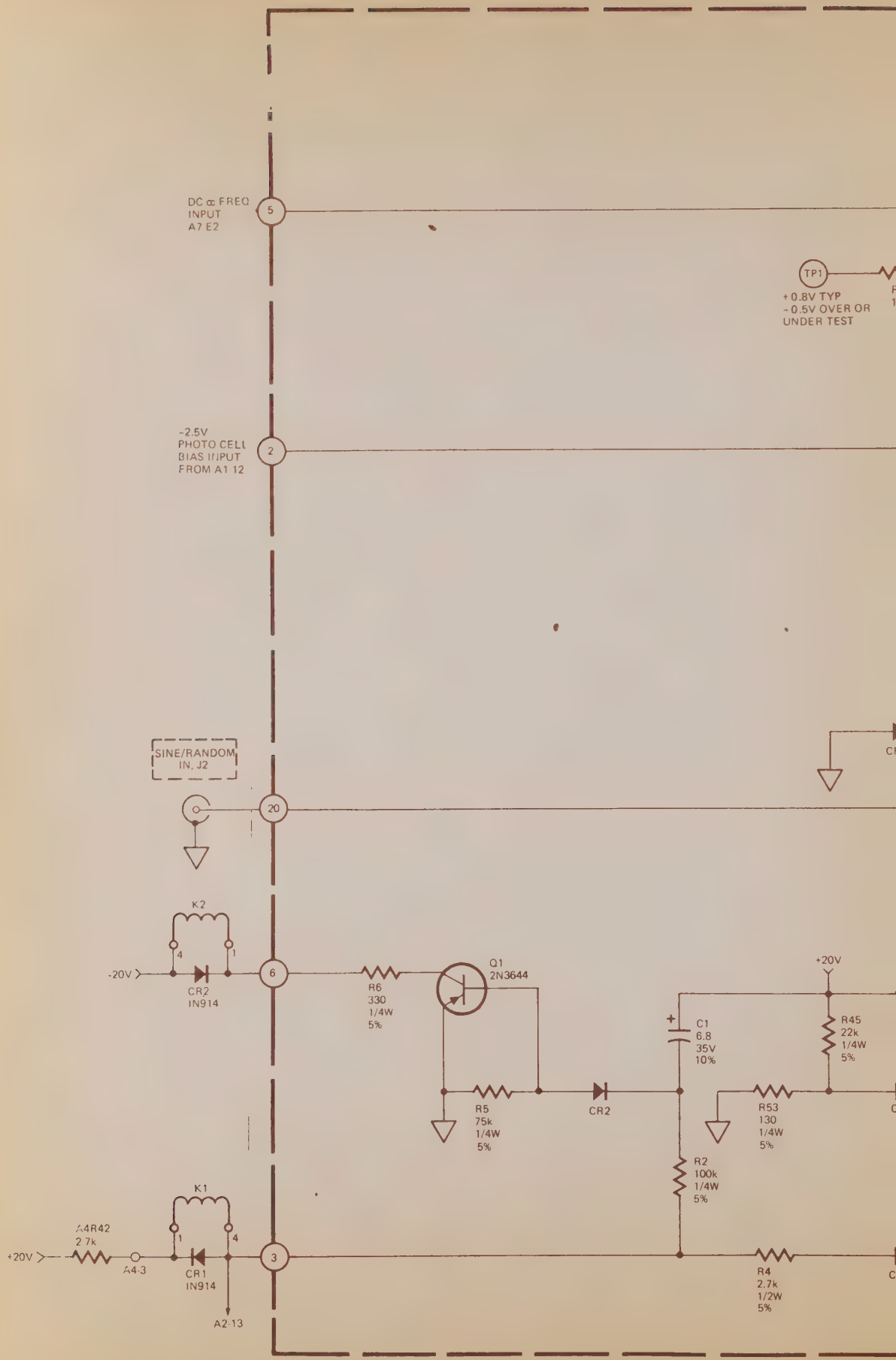
A2

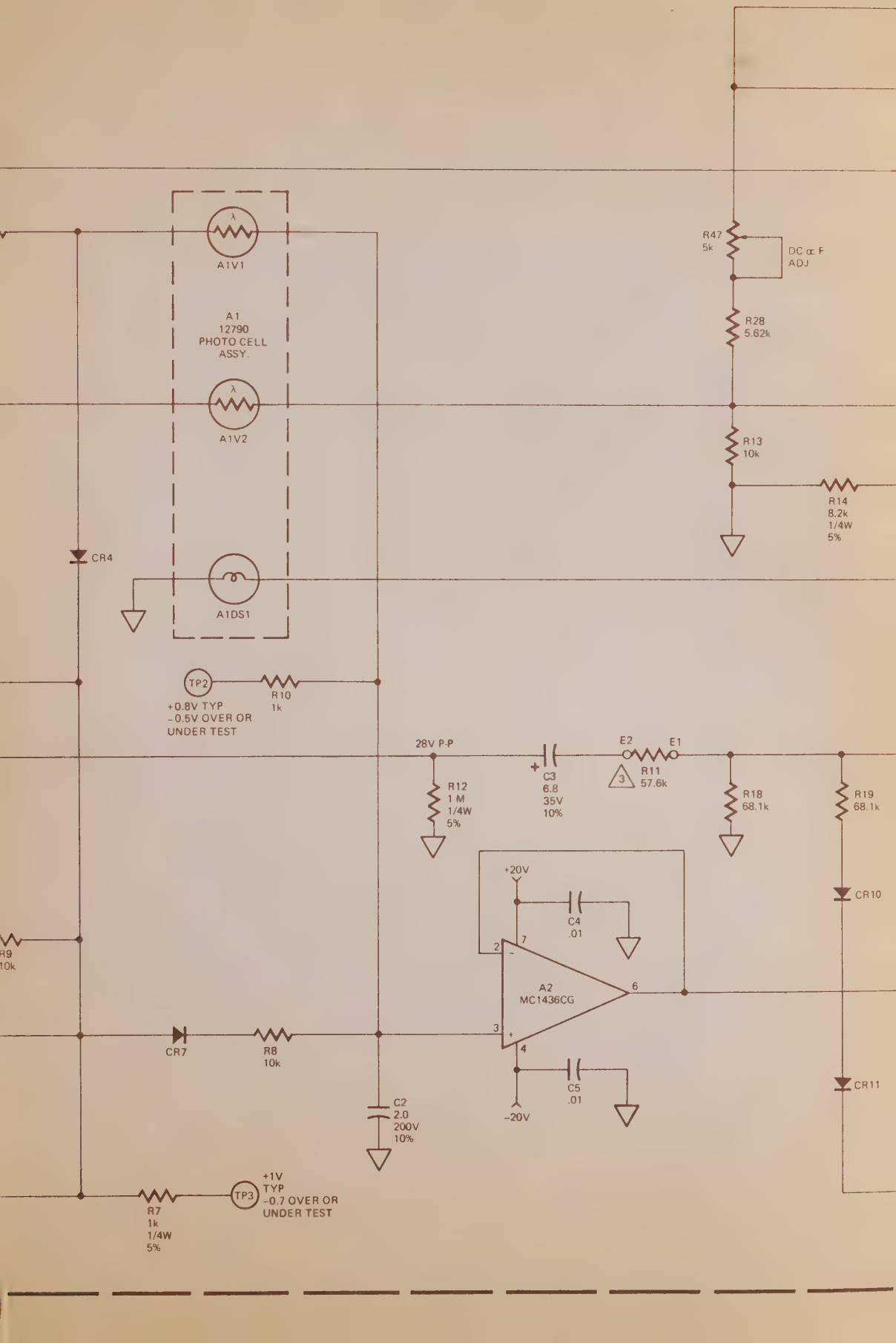
DRAWN	D. SRYGLEY	10-71
DESIGNER		
CHECKED		11-11-71
ENGINEER		11-12-71
APPROVED		11-17-71

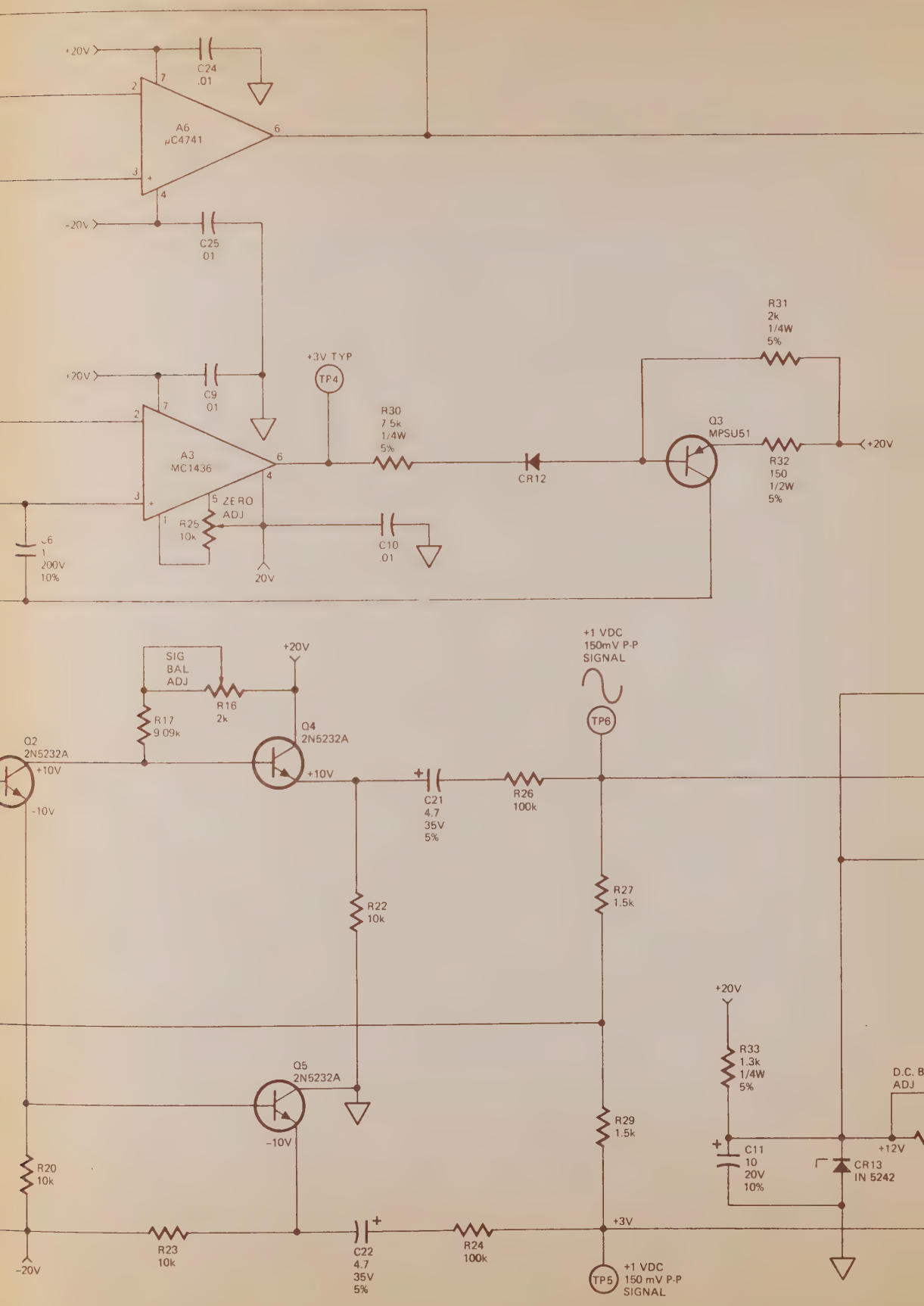
MODEL	SIZE	DRAWING NO.	REV
SD129		14191	B

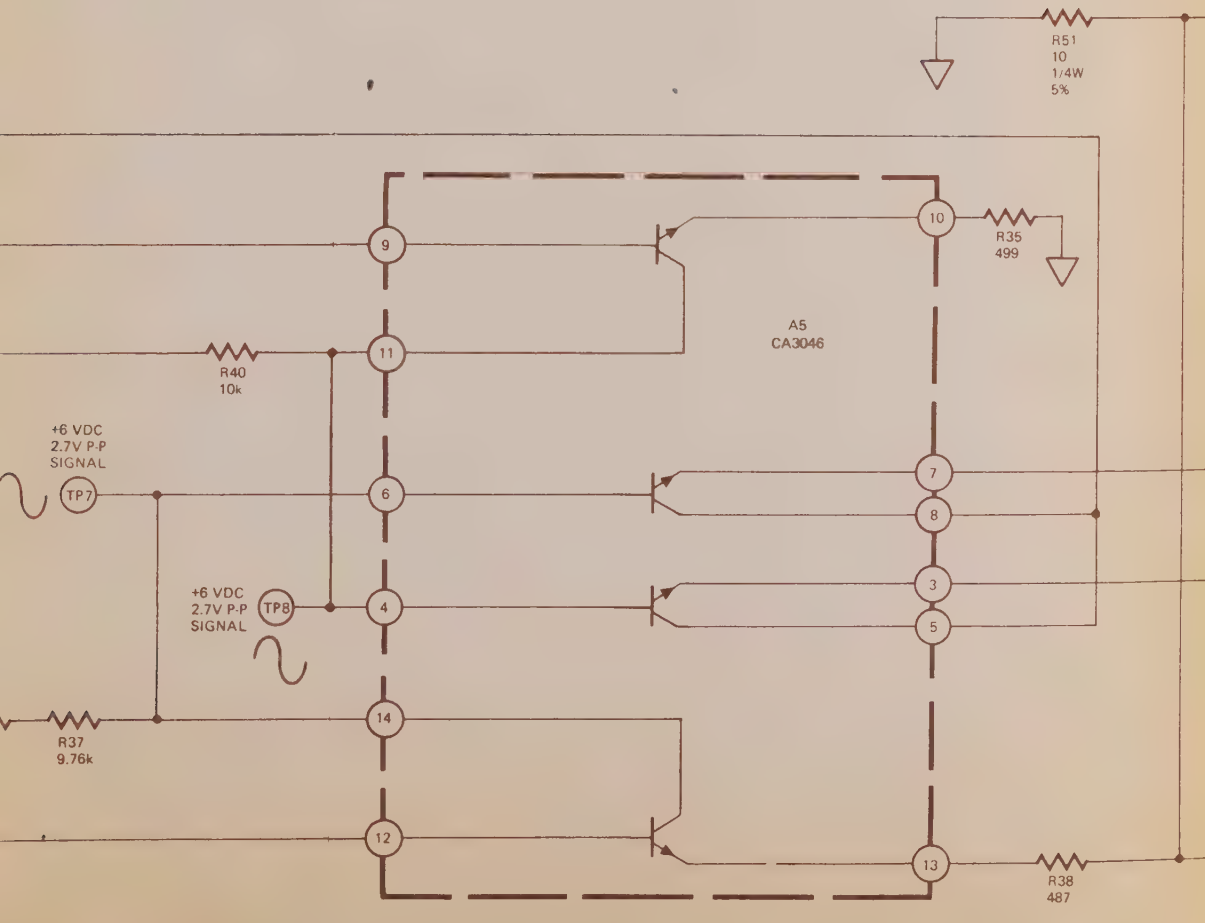
SCALE | SHEET 1 OF 1

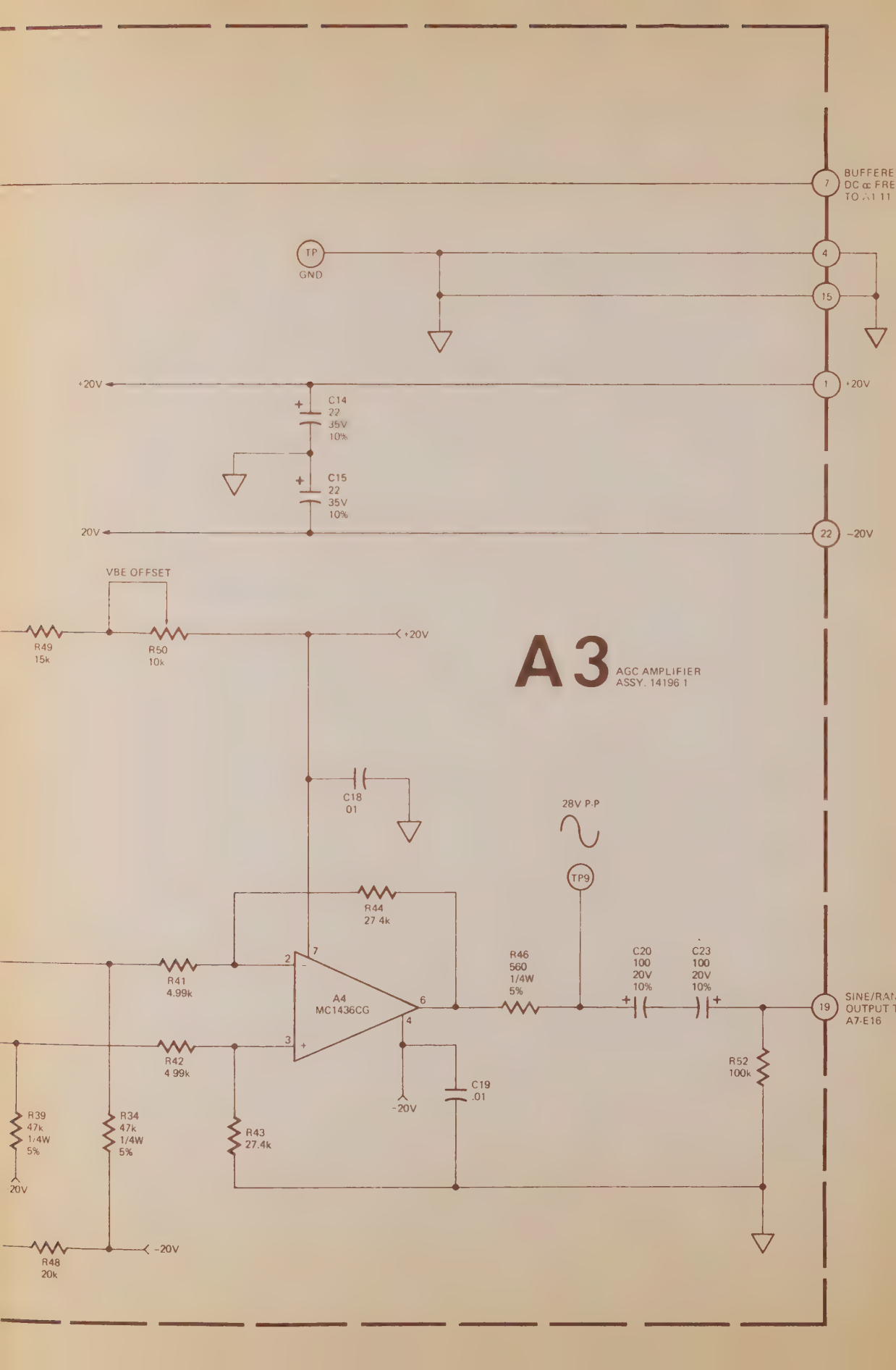

A3
AGC AMPLIFIER
ASSY. 14196-1
R17
R22
R18
Q4
Q5
Q2
E1
E2
R16
C21
C22
R23
R20
CR11
CR10
R19
R11
TP6
R27
R26
R29
R24
C15
TP5
C11
R44
R37
CR13
A4
C18
C3
R36
R33
R41
R42
R43
C19
R46
TP8
R40
TP9
R12
R52
R50
R49
R47
R28
R35
A5
TP7
R34
R39
C20
C23
R25
R32
R31
CR12
Q3
E
B
C
R38
R48
TP4
R30
R51
C9
C10
A3
C6
C24
C25
A6
R6
R13
R14
C4
C5
A1
A2
TP1
TP
GND
Q1
R5
CR2
R4
R2
C1
C14
C2
R3
TP3
V2
V1
V2
V1
CR4
R8
CR7
R7
CR3
CR8
CR6
R45
R53
TP2
R10
R9


DC ∝ FREQ
INPUT
A7 E2
5
TP1
+0.8V TYP
-0.5V OVER OR
UNDER TEST
-2.5V
PHOTO CELL
BIAS INPUT
FROM A1 12
2
SINE/RANDOM
IN, J2
20
K2
4
1
-20V
6
CR2
IN914
R6
330
1/4W
5%
Q1
2N3644
+20V
C1
6.8
35V
10%
R45
22k
1/4W
5%
R5
75k
1/4W
5%
CR2
R53
130
1/4W
5%
R2
100k
1/4W
5%
K1
A4R42
2.7k
1
4
+20V
3
A4-3
CR1
IN914
A2-13
R4
2.7k
1/2W
5%


A1V1
A1
12790
PHOTO CELL
ASSY.
A1V2
A1DS1
CR4
TP2
+0.8V TYP
-0.5V OVER OR
UNDER TEST
R10
1k
R47
5k
DC ∝ F
ADJ
R28
5.62k
R13
10k
R14
8.2k
1/4W
5%
28V P-P
R12
1 M
1/4W
5%
C3
6.8
35V
10%
E2
E1
R11
57.6k
R18
68.1k
R19
68.1k
CR10
CR11
+20V
C4
.01
A2
MC1436CG
-20V
C5
.01
CR7
R8
10k
C2
2.0
200V
10%
TP3
+1V
TYP
-0.7 OVER OR
UNDER TEST
R7
1k
1/4W
5%


+20V
C24
.01
A6
μC4741
-20V
C25
01
+20V
C9
01
A3
MC1436
+3V TYP
TP4
R30
7 5k
1/4W
5%
CR12
R31
2k
1/4W
5%
Q3
MPSU51
R32
150
1/2W
5%
+20V
ZERO
ADJ
R25
10k
C10
.01
20V
C6
1
200V
10%
SIG
BAL
ADJ
R16
2k
+20V
R17
9 09k
Q4
2N5232A
Q2
2N5232A
+10V
-10V
+1 VDC
150mV P-P
SIGNAL
TP6
C21
4.7
35V
5%
R26
100k
R22
10k
R27
1.5k
Q5
2N5232A
-10V
R20
10k
R23
10k
C22
4.7
35V
5%
R24
100k
+3V
TP5
+1 VDC
150 mV P-P
SIGNAL
+20V
R33
1.3k
1/4W
5%
C11
10
20V
10%
CR13
IN 5242
+12V
R29
1.5k


R51
10
1/4W
5%
A5
CA3046
9
10
R35
499
11
R40
10k
+6 VDC
2.7V P-P
SIGNAL
TP7
6
7
8
+6 VDC
2.7V P-P
SIGNAL
TP8
4
3
5
14
R37
9.76k
12
13
R38
487


BUFFERE
DC & FRE
TO A1 11
7
TP
GND
4
15
+20V
1
+20V
C14
22
35V
10%
C15
22
35V
10%
20V
22
-20V
VBE OFFSET
R49
15k
R50
10k
+20V
A3
AGC AMPLIFIER
ASSY. 14196 1
C18
01
28V P-P
TP9
R44
27.4k
R41
4.99k
2
7
A4
MC1436CG
6
4
3
R46
560
1/4W
5%
C20
100
20V
10%
C23
100
20V
10%
19
SINE/RA
OUTPUT
A7-E16
R42
4.99k
C19
.01
-20V
R52
100k
R39
47k
1/4W
5%
R34
47k
1/4W
5%
R43
27.4k
20V
R48
20k
-20V

REVISIONS						
REV	ECO	S/N	DESCRIPTION	DRAFT	CHECK	APP'D
A	—	011	REDRAWN	D.S. 11-71		11/3/71 BP

OUT

NOTES: UNLESS OTHERWISE INDICATED;

1. ALL RESISTORS ARE IN OHMS; 1/8W, 1%.
   ALL CAPACITORS ARE IN MICROFARADS, 50V, +80, -20%.
2. ALL DIODES ARE TYPE IN914.
3. FACTORY SELECT WITH TYPICAL VALUE SHOWN.

OM

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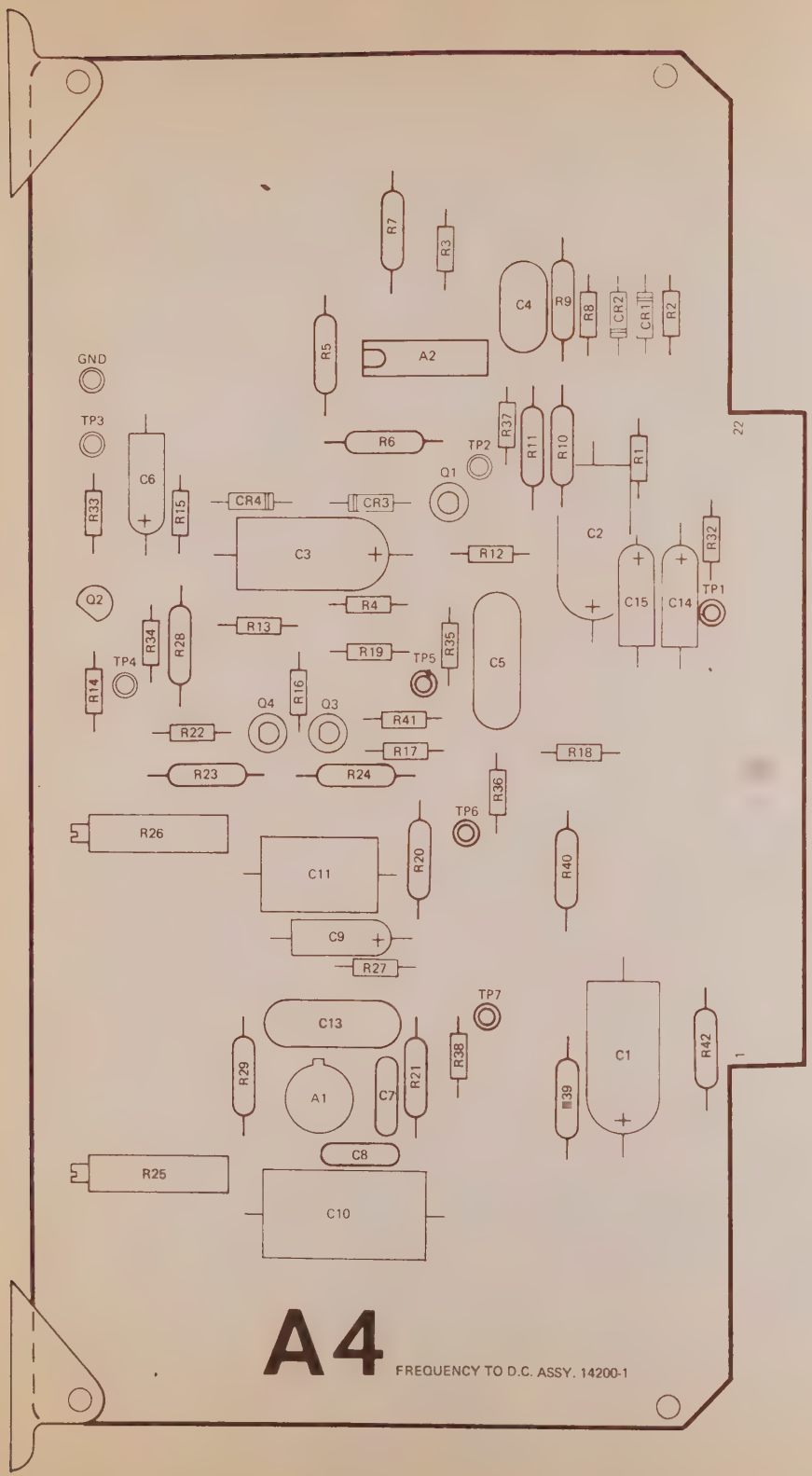
SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO

TITLE
SCHEMATIC/COMPONENT LAYOUT
AGC AMPLIFIER
ASSEMBLY 14196-1
A3

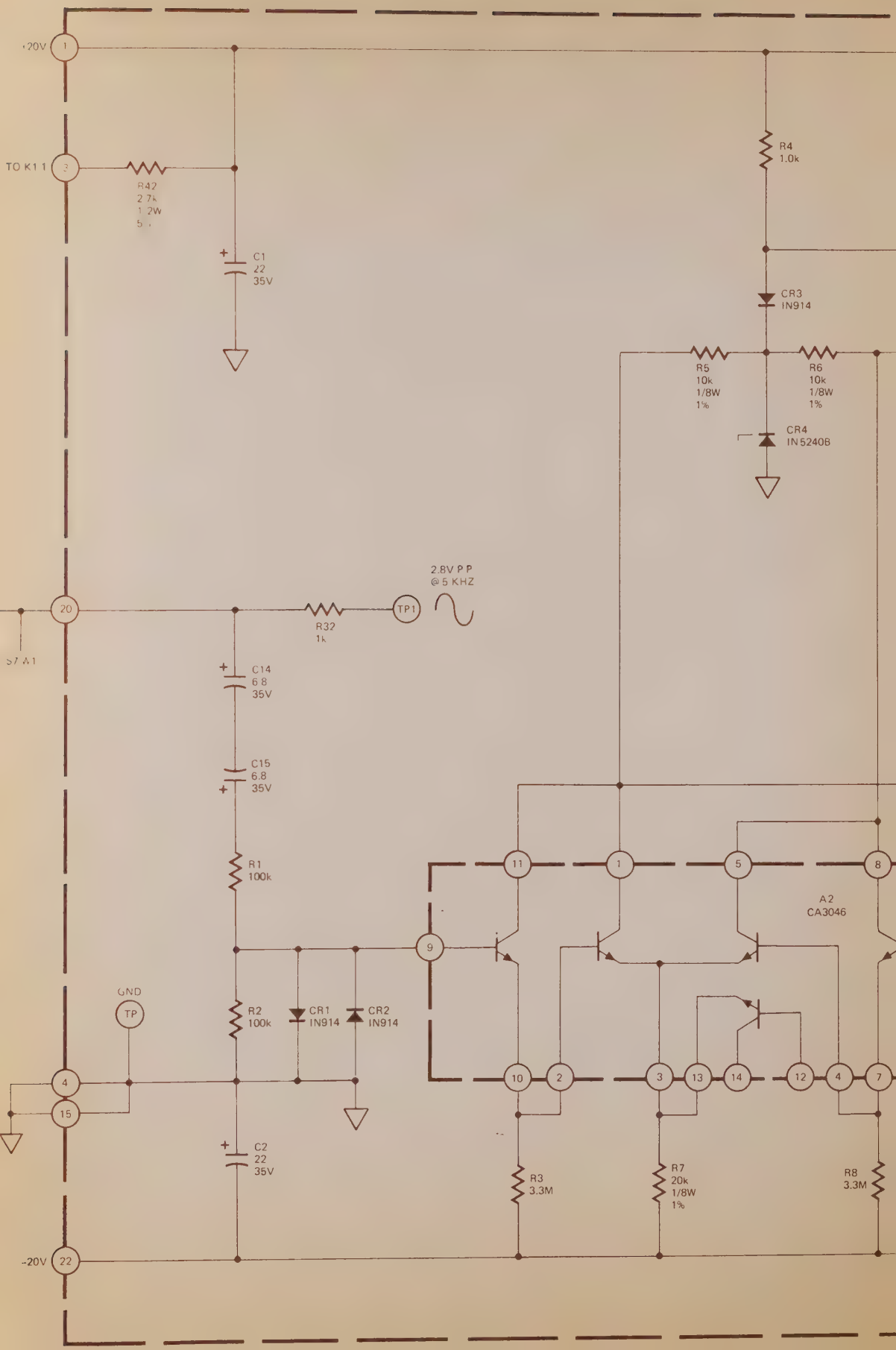
DRAWN	D. SRYGLEY	11-71
DESIGNER		
CHECKED		11 11 71
ENGINEER		11-12-71
APPROVED	BP	11/15/71

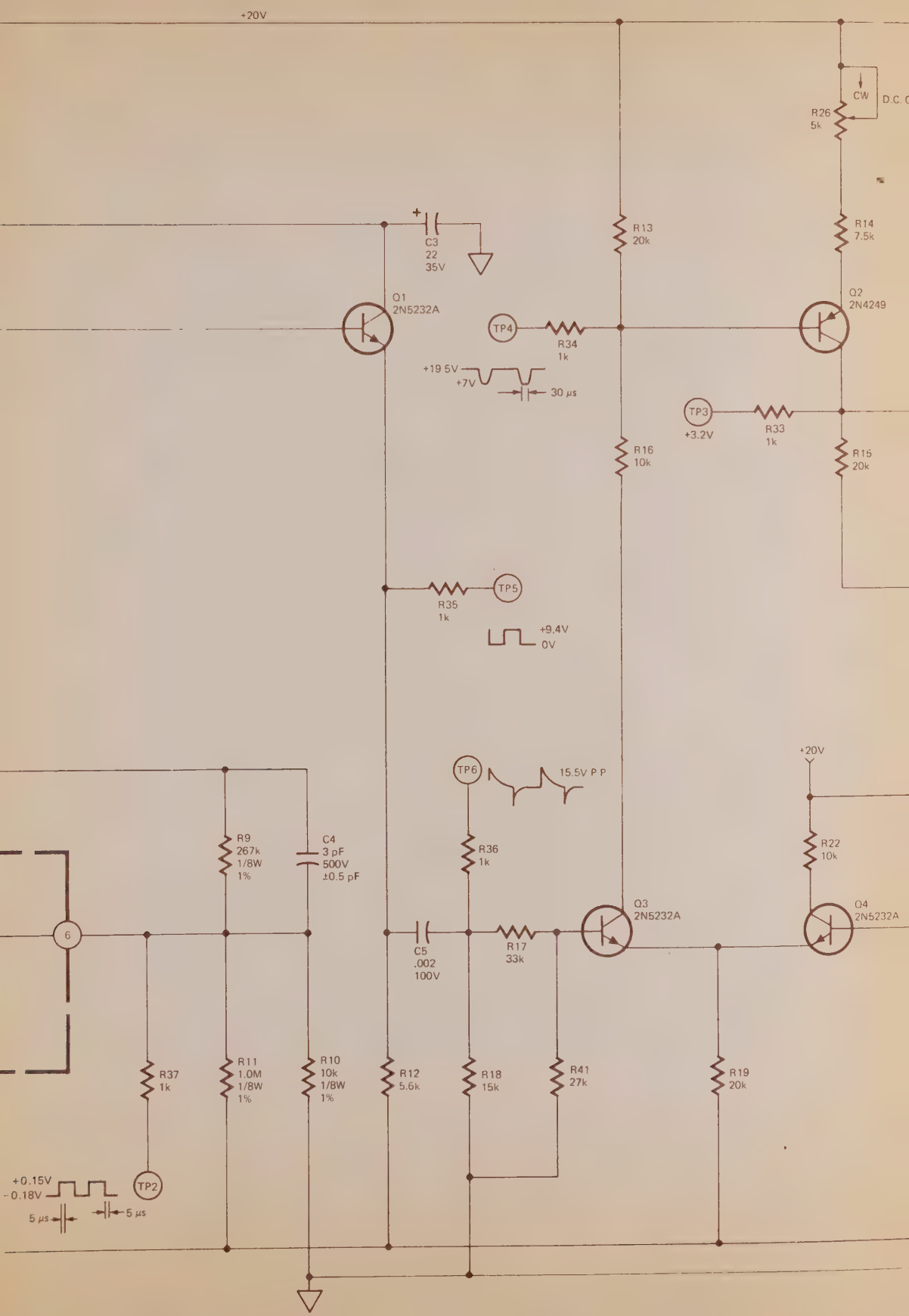
MODEL	SIZE	DRAWING NO.	REV
SD129		14197	A

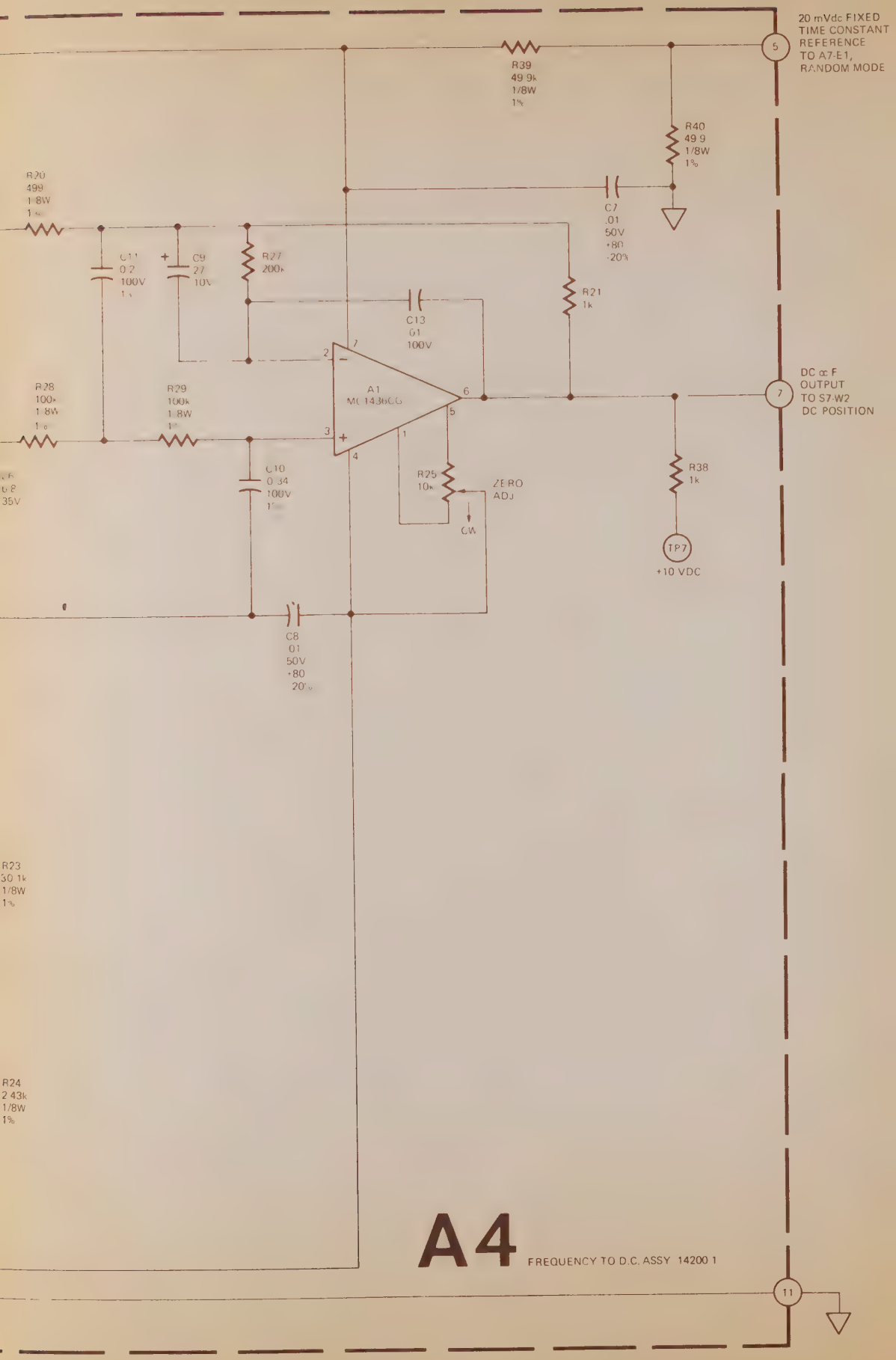
SCALE | SHEET 1 OF 1



SINE/RAND
IN, J2, A3-20


+20V
1
TO K1 1
3
R42
2.7k
1.2W
5%
C1
22
35V
R4
1.0k
CR3
IN914
R5
10k
1/8W
1%
R6
10k
1/8W
1%
CR4
IN5240B
2.8V P P
@ 5 KHZ
20
TP1
R32
1k
C14
6.8
35V
C15
6.8
35V
R1
100k
11
1
5
8
A2
CA3046
9
GND
TP
R2
100k
CR1
IN914
CR2
IN914
4
15
10
2
3
13
14
12
4
7
C2
22
35V
R3
3.3M
R7
20k
1/8W
1%
R8
3.3M
-20V
22


+20V
R26
5k
CW
D.C.
R14
7.5k
C3
22
35V
R13
20k
Q1
2N5232A
Q2
2N4249
TP4
R34
1k
+19.5V
+7V
30 µs
TP3
+3.2V
R33
1k
R16
10k
R15
20k
TP5
R35
1k
+9.4V
0V
TP6
15.5V P P
+20V
R9
267k
1/8W
1%
C4
3 pF
500V
±0.5 pF
R36
1k
R22
10k
Q3
2N5232A
Q4
2N5232A
6
C5
.002
100V
R17
33k
R37
1k
R11
1.0M
1/8W
1%
R10
10k
1/8W
1%
R12
5.6k
R18
15k
R41
27k
R19
20k
+0.15V
-0.18V
TP2
5 µs
5 µs


20 mVdc FIXED TIME CONSTANT REFERENCE TO A7-E1, RANDOM MODE
5
R39
49 9k
1/8W
1%
R40
49 9
1/8W
1%
R20
499
1/8W
1%
C7
.01
50V
+80
-20%
C11
0.2
100V
1%
C9
27
10V
R27
200k
C13
.01
100V
R21
1k
A1
MC1436CG
7
2
3
4
6
5
1
DC ∝ F
OUTPUT
TO S7-W2
DC POSITION
7
R28
100k
1/8W
1%
R29
100k
1/8W
1%
C10
0.34
100V
1%
R25
10k
ZERO
ADJ
CW
R38
1k
TP7
+10 VDC
C8
.01
50V
+80
20%
R23
30.1k
1/8W
1%
R24
2.43k
1/8W
1%
A4
FREQUENCY TO D.C. ASSY 14200-1
11

REVISIONS						
REV	ECO	S/N	DESCRIPTION	DRAFT	CHECK	APPD
A	—	011	REDRAWN	D.S. 11 71		

NOTES: UNLESS OTHERWISE INDICATED;

1 RESISTOR VALUES ARE IN OHMS, 1/4W, 5%.
CAPACITOR VALUES ARE IN MICROFARADS, 10%.

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SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO

DRAWN	D. SRYGLEY	11 71
DESIGNER		
CHECKED		11-11-71
ENGINEER		11-12-71
APPROVED		11/15/71

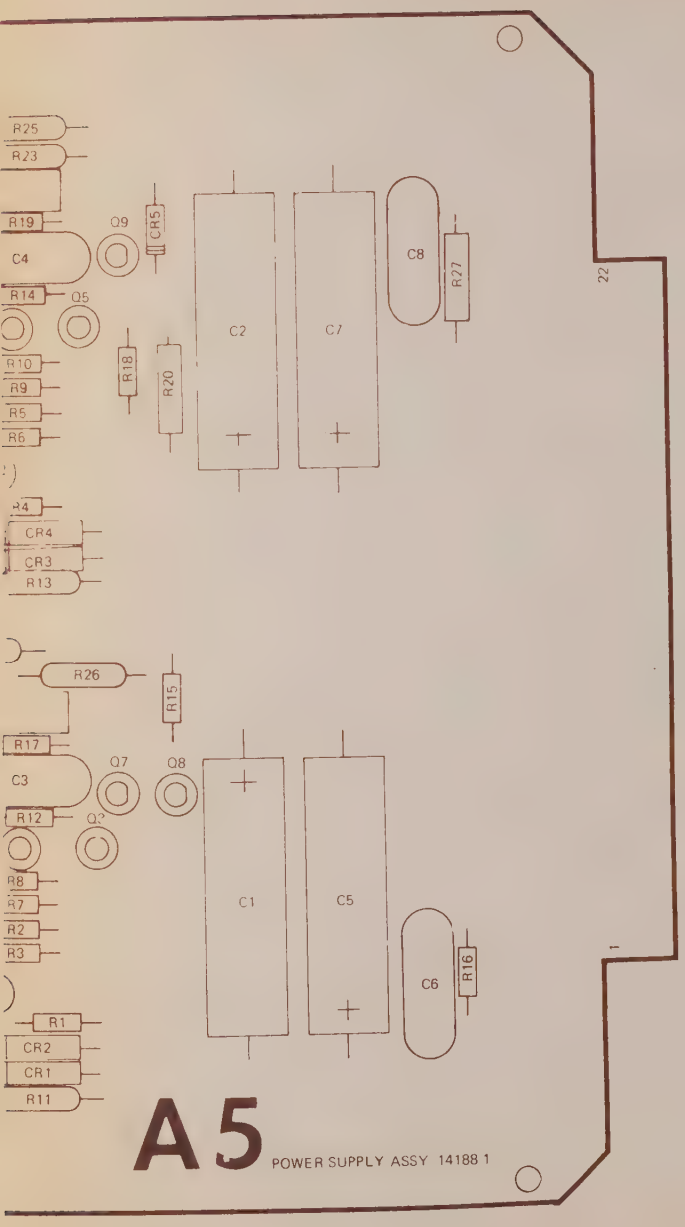
TITLE
SCHEMATIC/COMPONENT LAYOUT
FREQUENCY TO D.C.
ASSEMBLY 14200-1

A4

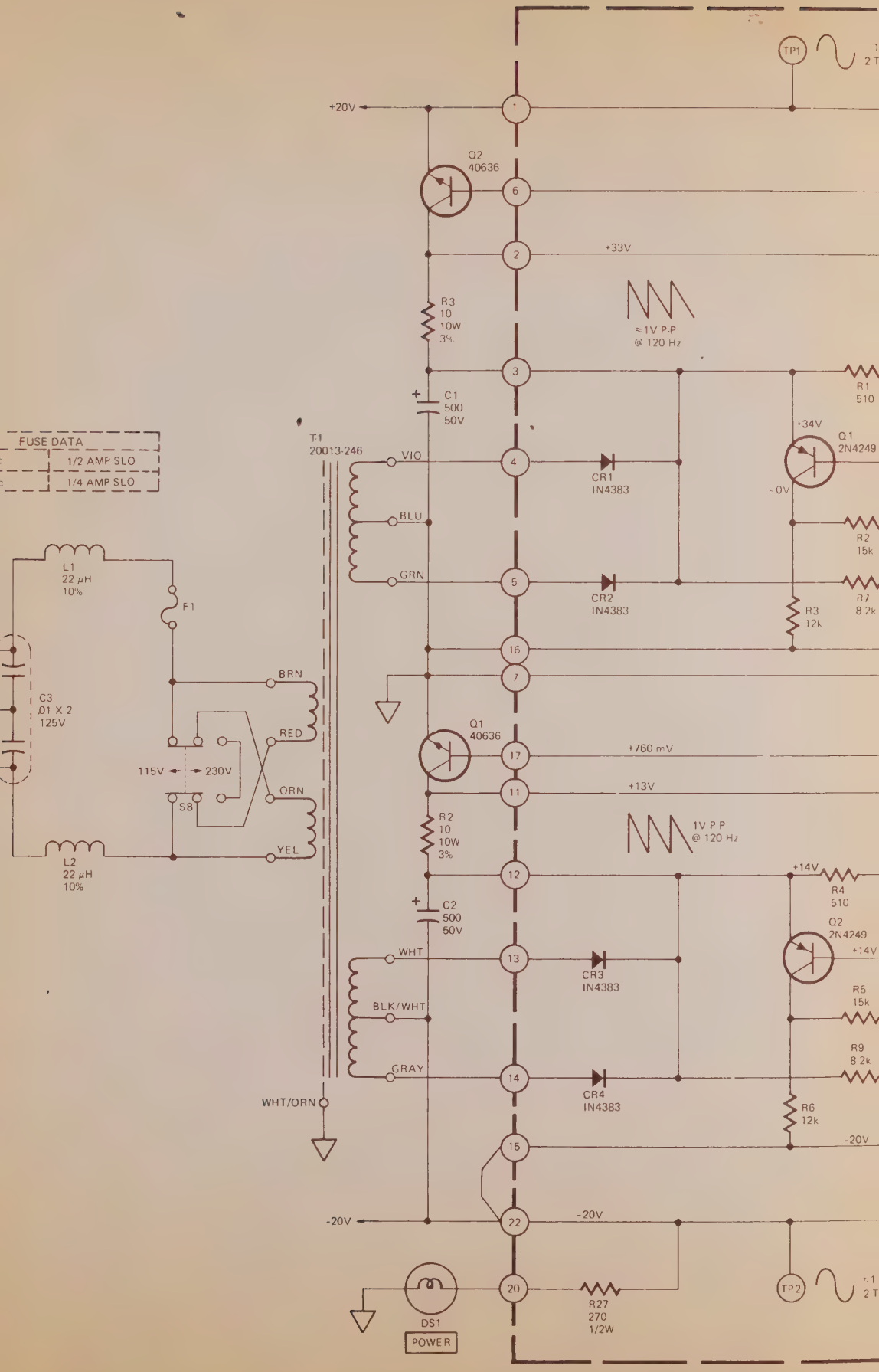
MODEL	SIZE	DRAWING NO.	REV
SD129		14198	A

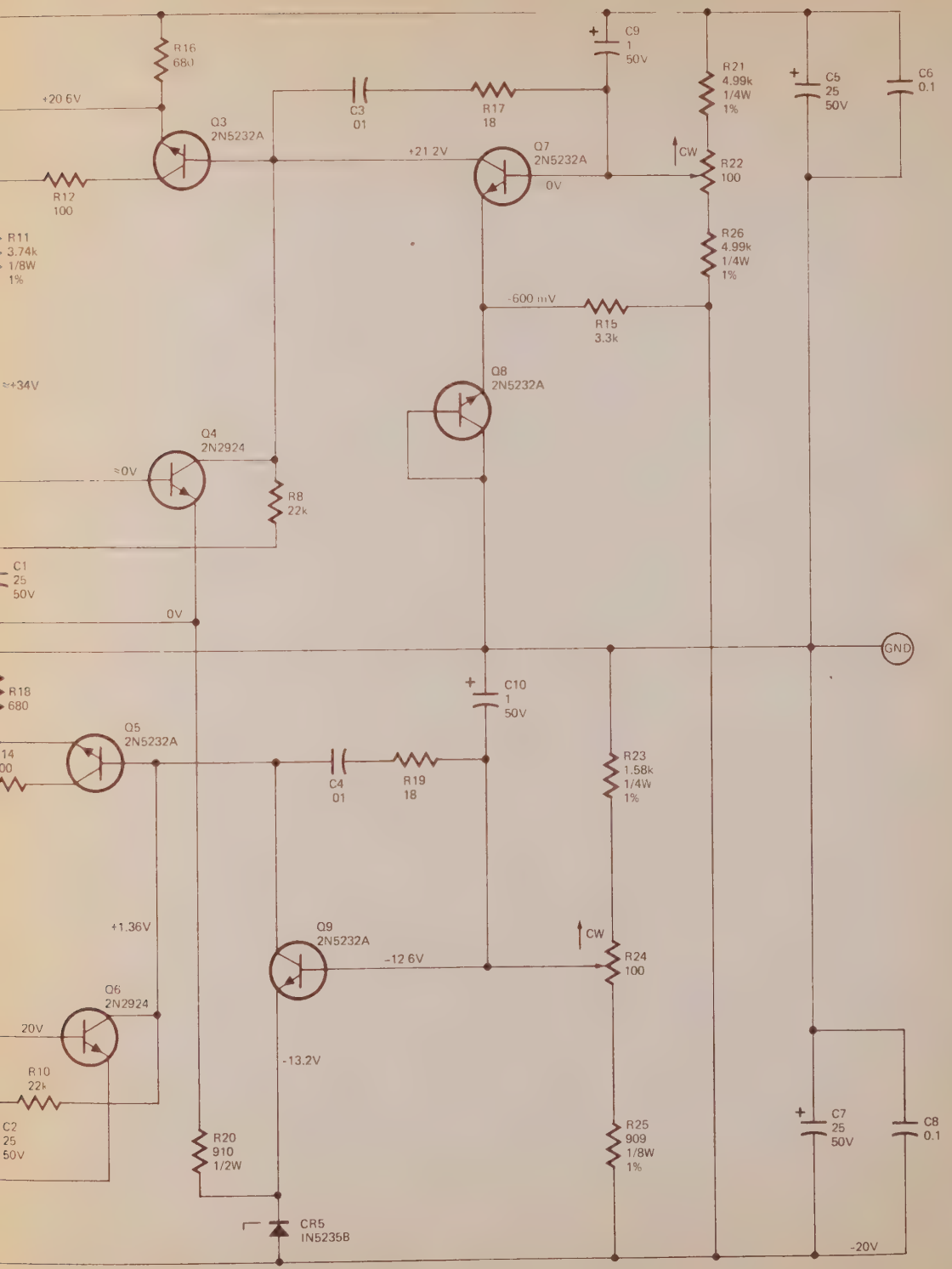
SCALE | SHEET 1 OF 1

TP1
GND
TP2
C9
C10


R25
R23
R19
Q9
CR5
C4
R14
Q5
C2
C7
C8
R27
R18
R20
R10
R9
R5
R6
CR4
CR3
R13
R26
R15
R17
Q7
Q8
C3
R12
C1
C5
C6
R16
R8
R7
R2
R3
R1
CR2
CR1
R11
22
A5
POWER SUPPLY ASSY 14188 1

POWER
IN
J7
3
2
1


FUSE DATA
1/2 AMP SLO
1/4 AMP SLO
L1
22 µH
10%
F1
C3
.01 X 2
125V
115V
230V
S8
L2
22 µH
10%
T1
20013-246
BRN
RED
ORN
YEL
VIO
BLU
GRN
WHT
BLK/WHT
GRAY
WHT/ORN
+20V
-20V
Q2
40636
R3
10
10W
3%
C1
500
50V
CR1
IN4383
CR2
IN4383
CR3
IN4383
CR4
IN4383
Q1
40636
R2
10
10W
3%
C2
500
50V
+33V
≈1V P-P
@ 120 Hz
+760 mV
+13V
1V P P
@ 120 Hz
DS1
POWER
R27
270
1/2W
TP1
TP2
+34V
Q1
2N4249
R1
510
R2
15k
R3
12k
R7
8.2k
+14V
R4
510
Q2
2N4249
R5
15k
R9
8.2k
R6
12k
1
2
3
4
5
6
7
11
12
13
14
15
16
17
20
22



A5

POWER SUPPLY ASSY. 14188-1

REVISIONS						
REV	ECO	S/N	DESCRIPTION	DRAFT	CHECK	APP'D
A	—	011	REDRAWN	D.S. 11-71		11/5/71 BP

NOTE: UNLESS OTHERWISE INDICATED.

1. ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 5%,
   ALL CAPACITORS ARE IN MICROFARADS, 100V, 10%.

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SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO

DRAWN	D. SRYGLEY	11 71
DESIGNER		
CHECKED		11-11-71
ENGINEER		
APPROVED	BP	11/5/71

TITLE

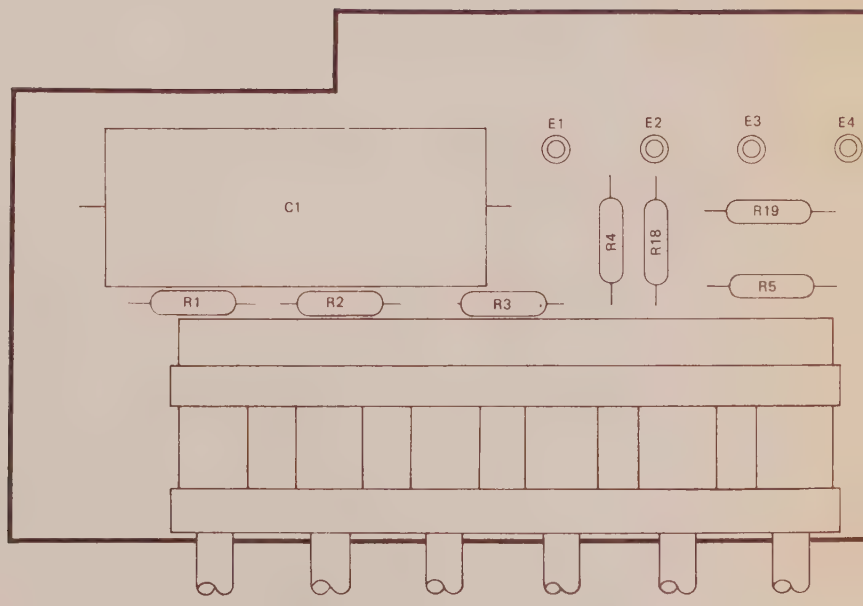
SCHEMATIC/COMPONENT LAYOUT POWER SUPPLY ASSEMBLY 14188-1

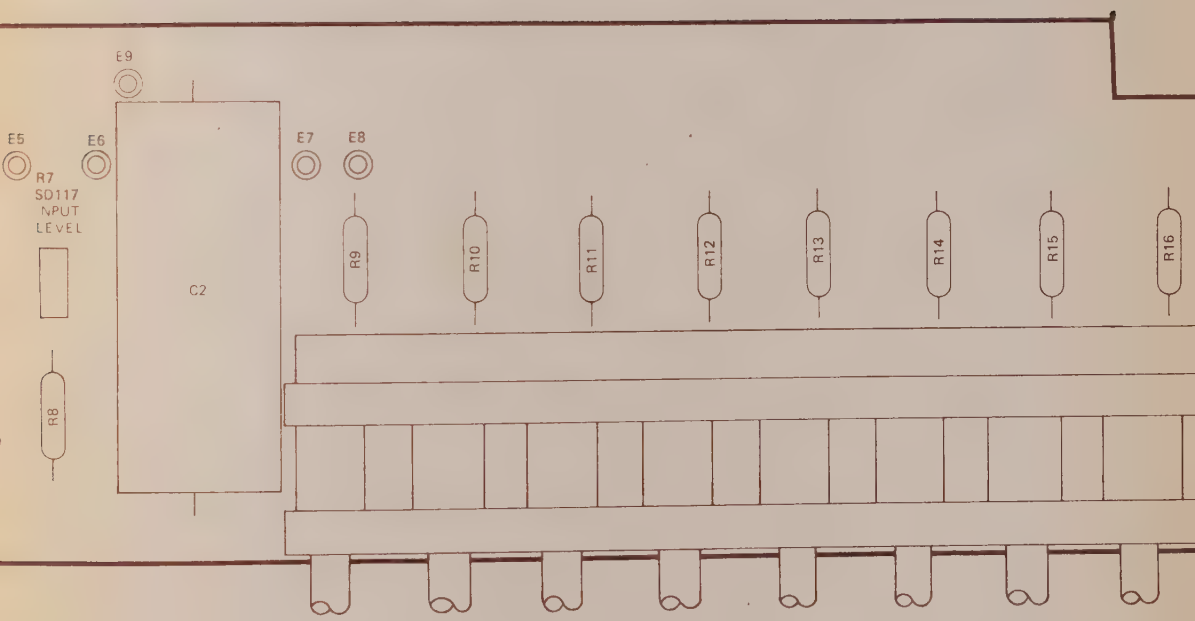
A5

MODEL	SIZE	DRAWING NO.	REV
SD129		14186	A

SCALE

SHEET 1 OF 1


E1
E2
E3
E4
C1
R4
R18
R19
R5
R1
R2
R3

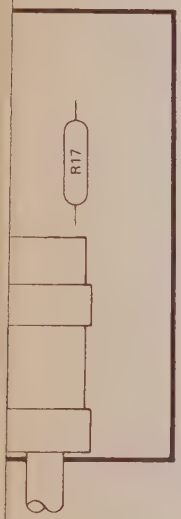


THE SCHEMATIC FOR THE UPPER SWITCH ASSEMBLY IS SHOWN ON THE INTERCONNECT DIAGRAM, DWG. NO. 14215

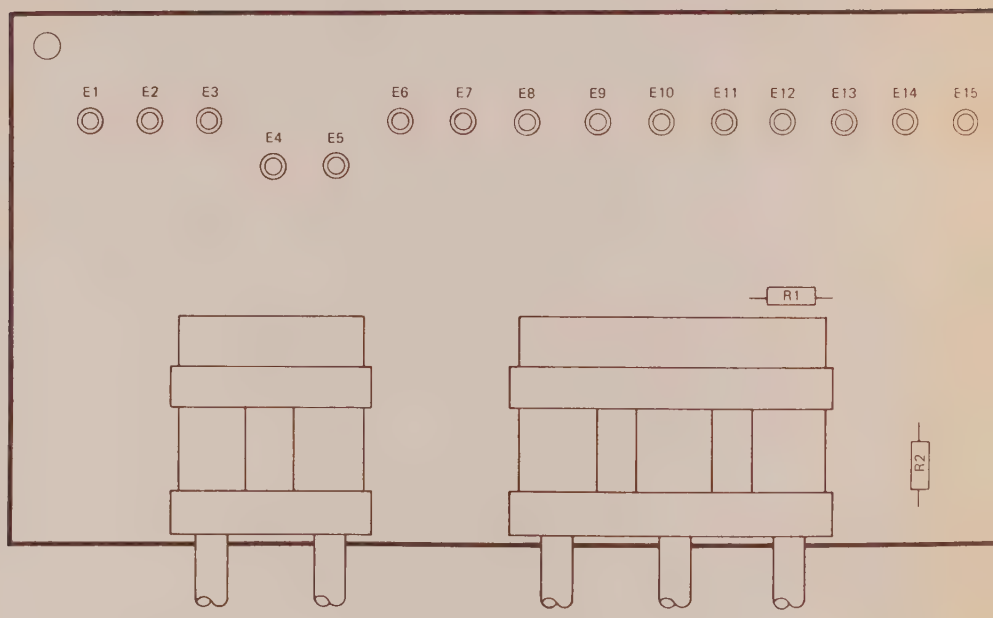
A6

UPPER SWITCH ASSY 14202 1

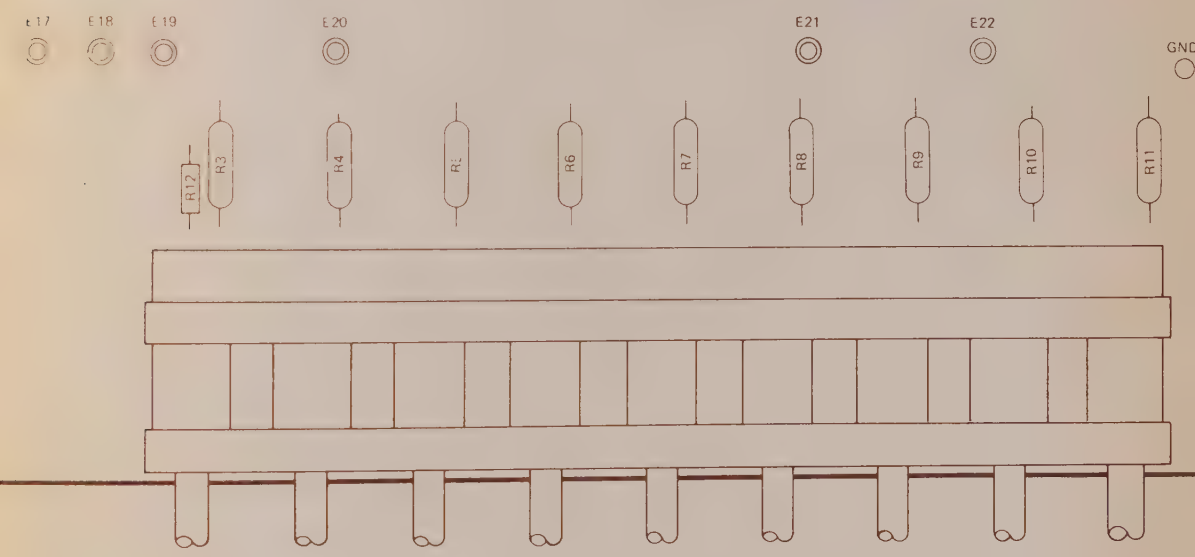
REVISIONS						
REV	ECO	S/N	DESCRIPTION	DRAFT	CHECK	APPD
B	—	011	REDRAWN	P.H. 11 71		BP 15/71



SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO			TITLE: UPPER SWITCH ASSEMBLY 14202-1			A6
DRAWN	P. HAASE	11.71	MODEL: SD129	SIZE:	DRAWING NO.: 14203	REV: B
DESIGNER						
CHECKED		11-15-71				
ENGINEER			SCALE:		SHEET 1 OF 1	
APPROVED	BP					



A



WER SWITCH ASSY 14206 1

HEMATIC FOR THE LOWER
H ASSEMBLY IS SHOWN ON
TERCONNECT DIAGRAM,
O. 14215

REVISIONS						
REV	ECO	S/N	DESCRIPTION	DRAFT	CHECK	APPD
A	—	011	REDRAWN	D.S. 11-71		

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SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO

TITLE: SCHEMATIC/COMPONENT LAYOUT LOWER SWITCH ASSEMBLY 14206-1

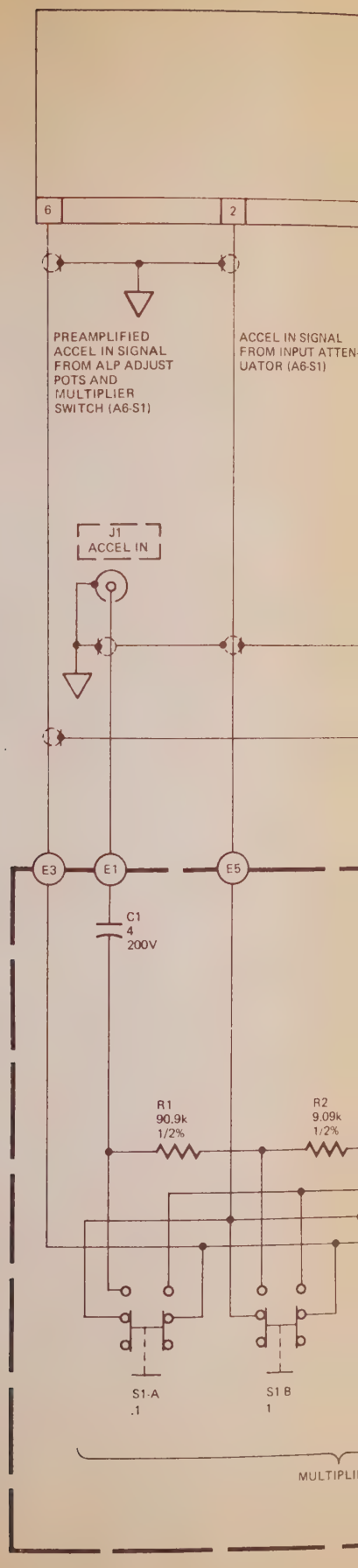
A7

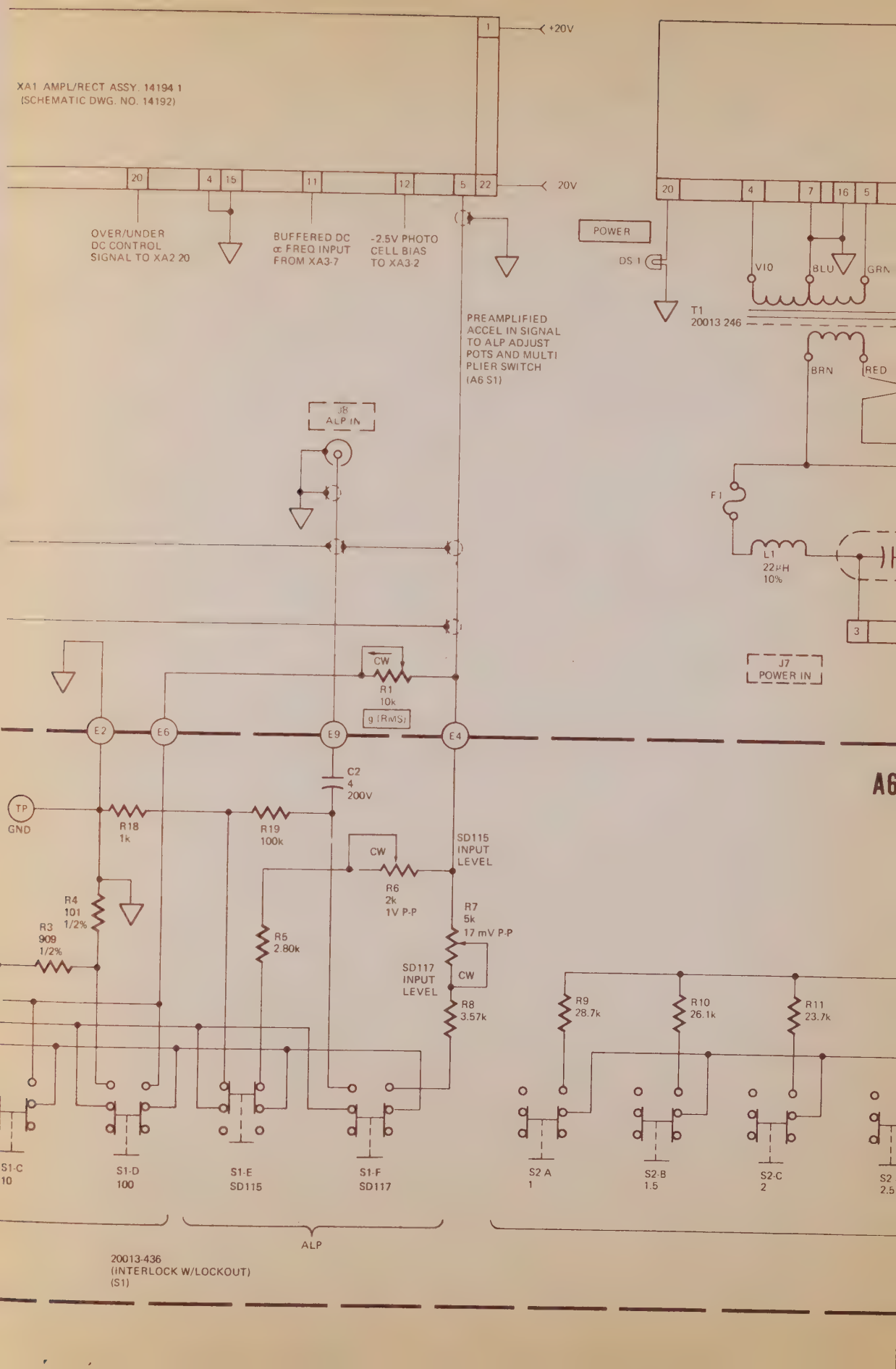
DRAWN	D. SRYGLEY	11-71
DESIGNER		
CHECKED		11-12-71
ENGINEER		
APPROVED		11-11-

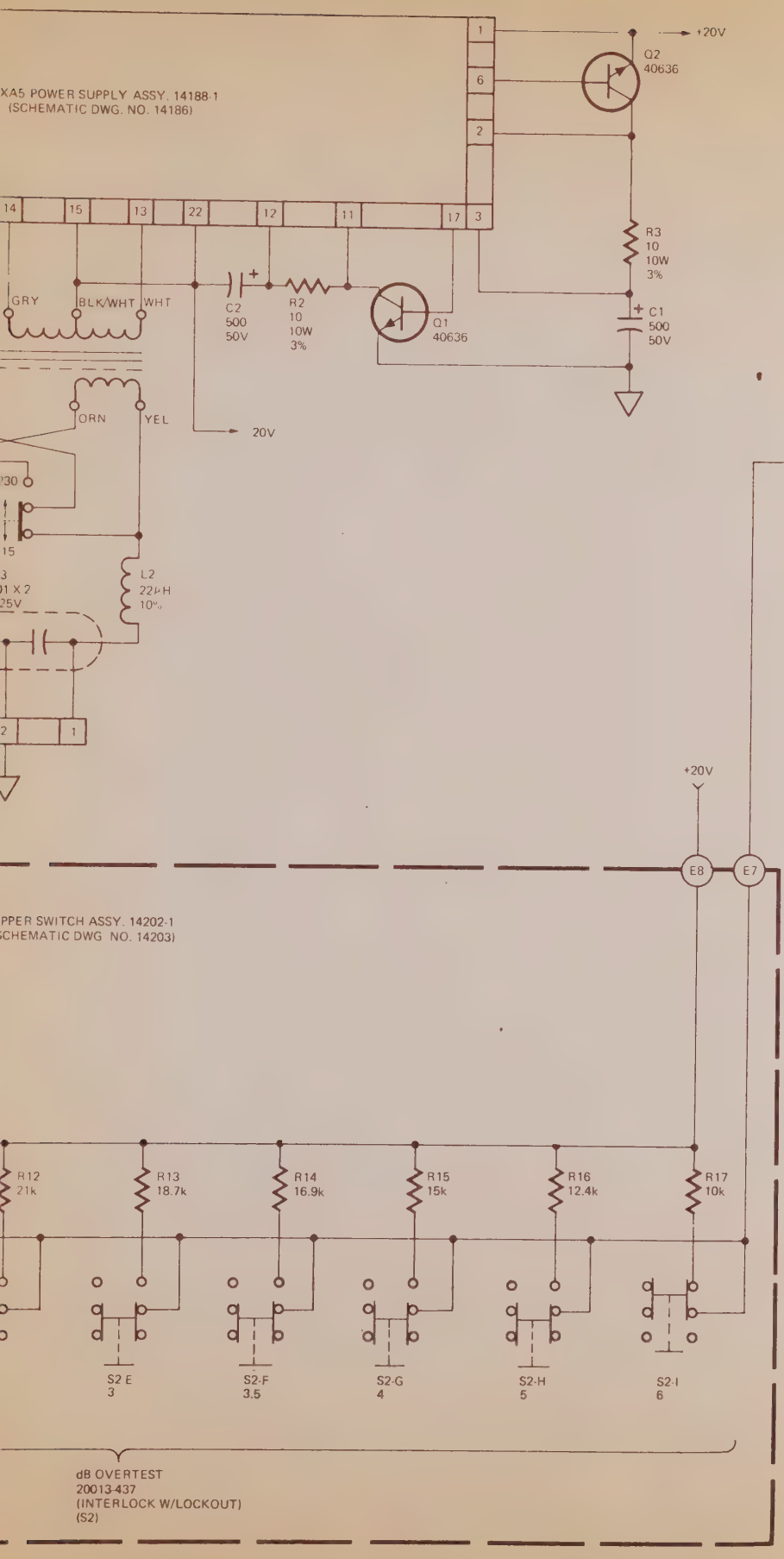
MODEL	SIZE	DRAWING NO.	REV
SD129		14204	A

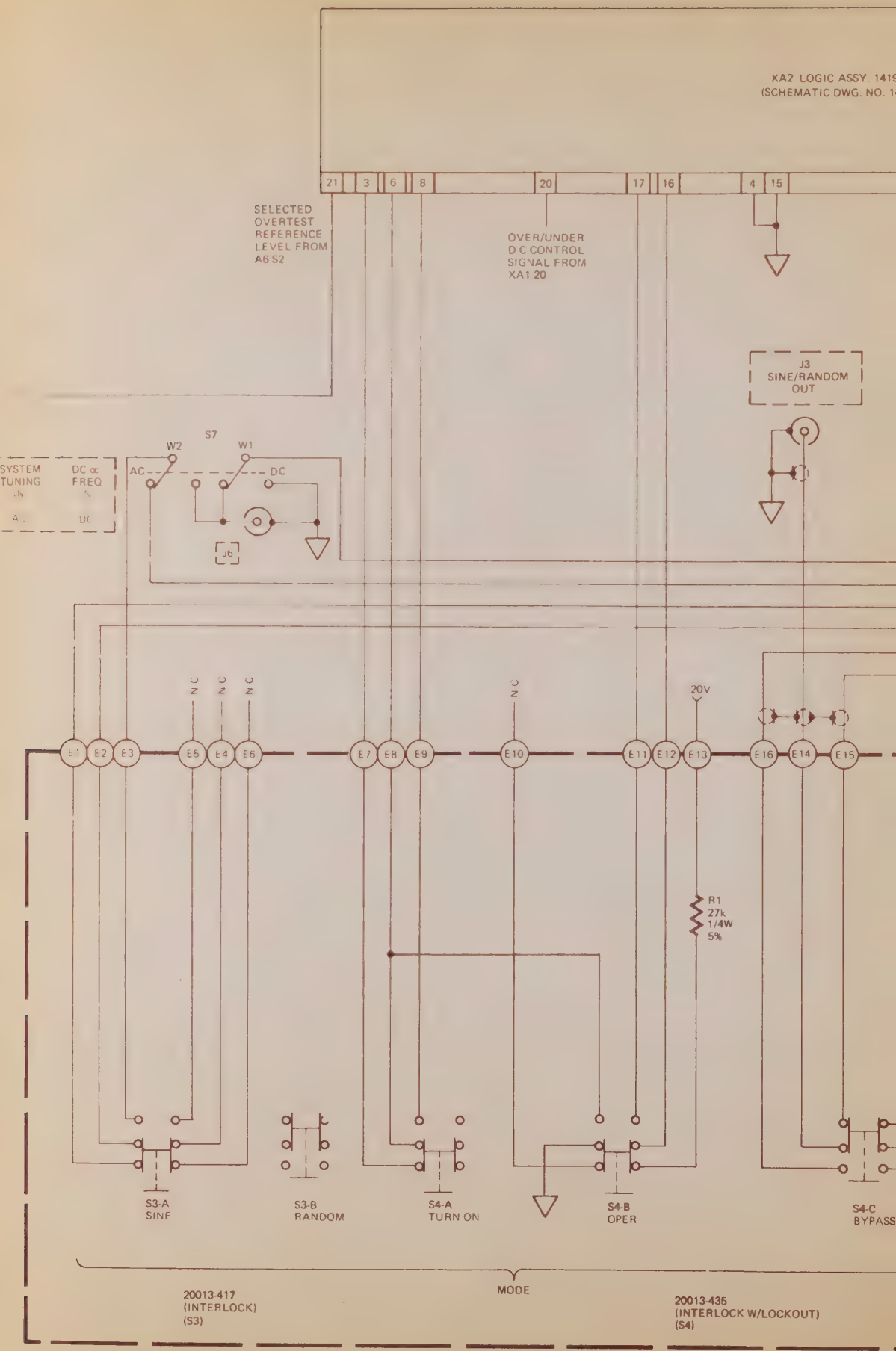
SCALE

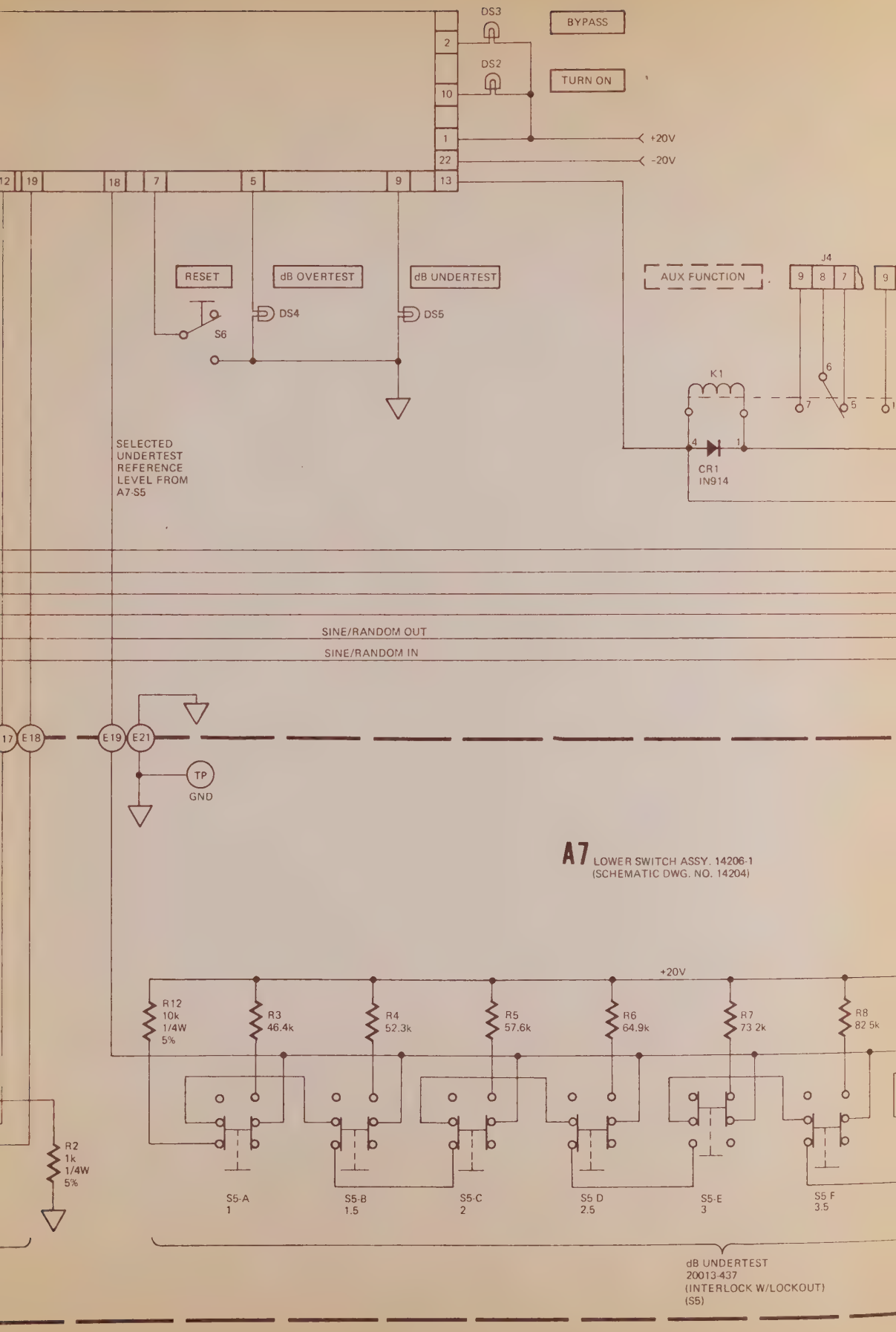
SHEET 1 OF 1

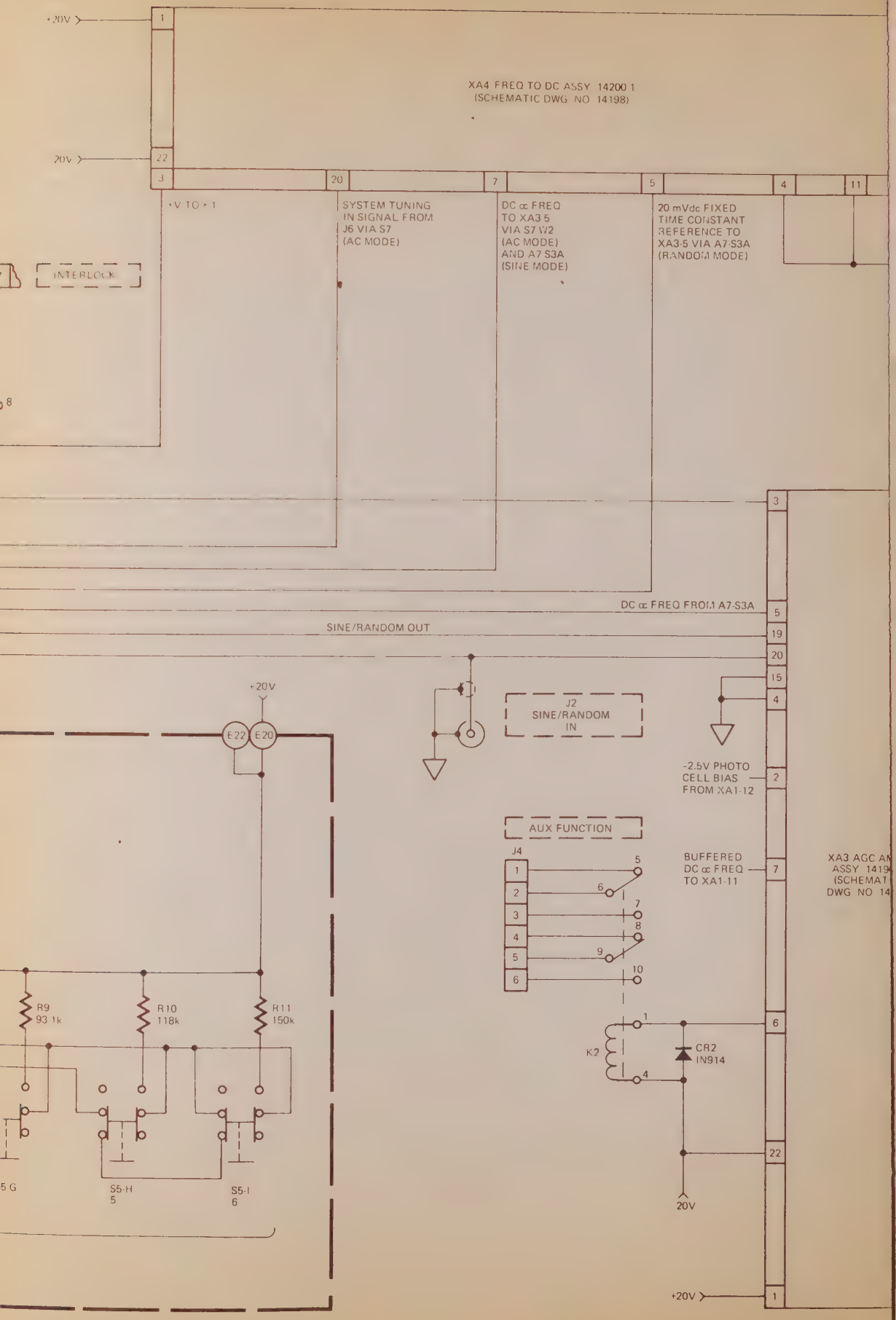

6
2
PREAMPLIFIED ACCEL IN SIGNAL FROM ALP ADJUST POTS AND MULTIPLIER SWITCH (A6-S1)
ACCEL IN SIGNAL FROM INPUT ATTEN-
UATOR (A6-S1)
J1
ACCEL IN
E3
E1
E5
C1
4
200V
R1
90.9k
1/2%
R2
9.09k
1/2%
S1-A
.1
S1 B
1
MULTIPLI


XA1 AMPL/RECT ASSY. 14194-1
(SCHEMATIC DWG. NO. 14192)
1
+20V
20
4
15
11
12
5
22
20V
OVER/UNDER
DC CONTROL
SIGNAL TO XA2 20
BUFFERED DC
∝ FREQ INPUT
FROM XA3-7
-2.5V PHOTO
CELL BIAS
TO XA3-2
PREAMPLIFIED
ACCEL IN SIGNAL
TO ALP ADJUST
POTS AND MULTI
PLIER SWITCH
(A6 S1)
POWER
DS 1
20
4
7
16
5
VIO
BLU
GRN
T1
20013 246
BRN
RED
F1
L1
22μH
10%
3
J7
POWER IN
J8
ALP IN
CW
R1
10k
g (RMS)
E2
E6
E9
E4
C2
4
200V
TP
GND
R18
1k
R19
100k
CW
SD115
INPUT
LEVEL
R6
2k
1V P-P
R7
5k
17 mV P-P
R4
101
1/2%
R3
909
1/2%
R5
2.80k
SD117
INPUT
LEVEL
CW
R8
3.57k
R9
28.7k
R10
26.1k
R11
23.7k
S1-C
10
S1-D
100
S1-E
SD115
S1-F
SD117
S2 A
1
S2-B
1.5
S2-C
2
S2
2.5
ALP
20013-436
(INTERLOCK W/LOCKOUT)
(S1)
A6


XA5 POWER SUPPLY ASSY. 14188-1
(SCHEMATIC DWG. NO. 14186)
1
6
2
+20V
Q2
40636
14
15
13
22
12
11
17
3
R3
10
10W
3%
GRY
BLK/WHT
WHT
C2
500
50V
R2
10
10W
3%
Q1
40636
C1
500
50V
ORN
YEL
20V
L2
22μH
10%
+20V
E8
E7
PPER SWITCH ASSY. 14202-1
SCHEMATIC DWG NO. 14203)
R12
21k
R13
18.7k
R14
16.9k
R15
15k
R16
12.4k
R17
10k
S2 E
3
S2-F
3.5
S2-G
4
S2-H
5
S2-I
6
dB OVERTEST
20013-437
(INTERLOCK W/LOCKOUT)
(S2)


XA2 LOGIC ASSY. 1419
(SCHEMATIC DWG. NO. 1
21
3
6
8
20
17
16
4
15
SELECTED OVERTEST REFERENCE LEVEL FROM A6 S2
OVER/UNDER D C CONTROL SIGNAL FROM XA1 20
J3 SINE/RANDOM OUT
S7
W2
W1
AC
DC
J6
SYSTEM TUNING
DC ∝ FREQ
20V
E1
E2
E3
E5
E4
E6
E7
E8
E9
E10
E11
E12
E13
E16
E14
E15
R1
27k
1/4W
5%
S3-A SINE
S3-B RANDOM
S4-A TURN ON
S4-B OPER
S4-C BYPASS
MODE
20013-417 (INTERLOCK) (S3)
20013-435 (INTERLOCK W/LOCKOUT) (S4)


DS3
BYPASS
2
DS2
TURN ON
10
1
+20V
22
-20V
12
19
18
7
5
9
13
RESET
dB OVERTEST
dB UNDERTEST
AUX FUNCTION
J4
9
8
7
9
S6
DS4
DS5
K1
6
7
5
4
1
CR1
IN914
SELECTED
UNDERTEST
REFERENCE
LEVEL FROM
A7-S5
SINE/RANDOM OUT
SINE/RANDOM IN
17
E18
E19
E21
TP
GND
A7 LOWER SWITCH ASSY. 14206-1
(SCHEMATIC DWG. NO. 14204)
+20V
R12
10k
1/4W
5%
R3
46.4k
R4
52.3k
R5
57.6k
R6
64.9k
R7
73 2k
R8
82 5k
R2
1k
1/4W
5%
S5-A
1
S5-B
1.5
S5-C
2
S5 D
2.5
S5-E
3
S5 F
3.5
dB UNDERTEST
20013-437
(INTERLOCK W/LOCKOUT)
(S5)


+20V
1
XA4 FREQ TO DC ASSY 14200 1
(SCHEMATIC DWG NO 14198)
20V
22
3
20
7
5
4
11
+V TO +1
SYSTEM TUNING
IN SIGNAL FROM
J6 VIA S7
(AC MODE)
DC ∝ FREQ
TO XA3 5
VIA S7 W2
(AC MODE)
AND A7 S3A
(SINE MODE)
20 mVdc FIXED
TIME CONSTANT
REFERENCE TO
XA3-5 VIA A7-S3A
(RANDOM MODE)
INTERLOCK
DC ∝ FREQ FROM A7-S3A
SINE/RANDOM OUT
+20V
E22
E20
J2
SINE/RANDOM
IN
-2.5V PHOTO
CELL BIAS
FROM XA1-12
AUX FUNCTION
J4
BUFFERED
DC ∝ FREQ
TO XA1-11
XA3 AGC AN
ASSY 1419
(SCHEMAT
DWG NO 14
R9
93 1k
R10
118k
R11
150k
S5-H
5
S5-I
6
K2
CR2
IN914
20V
+20V

REVISIONS						
REV	ECO	S/N	DESCRIPTION	DRAFT	CHECK	APPD
C	—	011	REDRAWN	G.B.C. 10-71		11/11/71 BP

15

NOTES: UNLESS OTHERWISE INDICATED

1. ALL RESISTORS ARE IN OHMS; 1/8W, 1%
ALL CAPACITORS ARE IN MICROFARADS.

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SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO

TITLE: INTERCONNECTING DIAGRAM

DRAWN	G. CLARE	10-71
DESIGNER		
CHECKED	[illegible]	11-11-71
ENGINEER		
APPROVED	BP	11/11/71

MODEL	SIZE	DRAWING NO.	REV
SD129		14215	C

SCALE | SHEET 1 OF 1

SD129
SINE/RANDOM SIGNAL VIBRATION PROTECTOR

VERSATILE PROTECTION FOR YOUR VIBRATION TEST

FEATURES

- Frequency controlled reaction time for optimum response
- Operates over 5 Hz to 10 kHz frequency range
- Sine or Random operation
- Operational mode indicators
- Direct compatibility with SD115A and SD117A Automatic Level Programmers
- Smooth safety shutdown to prevent jolting the test item or exciter
- Test limits calibrated directly in dB
- True rms level detection
- Absolute calibration to 10 mV rms/g rms
- Unaffected by power line transients
- Works with **any** servo controller

GENERAL DESCRIPTION

The Model SD129 Sine/Random Signal Vibration Protector is a safety device designed to operate with manual or automatic random equalizer/analyzers and automatic sine wave vibration servos. These include the Ling Model ASDE 40 and ASDE 80, MB Model T589, Spectral Dynamics Model SD104A/105B and SD114A. It is also directly compatible with the SD115A and SD117A Automatic Level Programmers, thereby providing protection during programmed level testing. The SD129 functions as a variable gain amplifier which is placed between the automatic equalizer or sine servo output and the power amplifier input.

SPECTRAL DYNAMICS CORPORATION OF SAN DIEGO
POST OFFICE BOX 671, SAN DIEGO, CALIFORNIA 92112
TELEPHONE 714—278-2501 • TWX 910-335-2022

10-71
S-027

SPECIFICATIONS* (Continued)

OUTPUTS

Sine/Random Output (BNC type connector)

Gain	Unity ±1 dB
Impedance	560 ohms coupled through 50 μF (8 mA rms maximum)
Frequency Response	5 Hz to 10 kHz (±0.5 dB)
Dynamic Range	80 dB
Distortion	Less than 0.5%

(Random)

Level	2 Vrms maximum
Compression Time	Approximately 1 second or less for 80 dB compression

(Sine)

Level	10 Vrms maximum

Compression Time

Frequency	Approx Time (Second)
5 Hz to 10 Hz	1
100 Hz	0.3
1 kHz	0.035
5 kHz to 10 kHz	0.01

Interlock (Multi-Pin Connector)

N.O. and N.C. (SPDT) relay contacts which actuate simultaneously with detection of either over or under limit condition.

Contact Ratings . . . . . 115 Vac at 0.25A, 0.2 ohm maximum

AUX FUNCTIONS (Multi-Pin Connector)

N.O. and N.C. (SPDT) relay contacts which actuate simultaneously with detection of either over or under limit condition. Two sets of N.O. and N.C. (SPDT) relay contacts which actuate 0.5 second following detection of either over or under limit condition.

Contact Ratings . . . . . 115 Vac at 0.25A, 0.2 ohm maximum

OPERATIONAL MODES (Switch-selectable on front panel)

Bypass	Bypasses unit completely through switch contacts; indicated by blinking red light on front panel.
Turn On	Intended for use mainly to bring the system "on the air"; i.e., to get the test above the preset undertest limit. Blinking amber light indicates protection of the system for an overtest condition only; not an indication of an undertest condition.
Operate	Normally selected after the system has reached the test level or at least above the preset undertest limit. In this mode, the system is protected from both an overtest and undertest.

PRESET LIMITS . . . . . Two front panel switches for selection of nine limits for undertest and overtest (1, 1.5, 2, 2.5, 3, 3.5, 4, 5 and 6 dB fixed positions).

Preset Level Accuracy . . . . . ±0.5 dB

TEST LIMIT INDICATION . . . . . Front panel lamps indicate if and when an over- or undertest limit has been reached.

RESET . . . . . A front panel RESET push button allows for resetting the SD129 logic once the unit has detected a limit.

POWER . . . . . 105–125/210–250 Vac switch selectable on rear of chassis; 50–400 Hz at ≈20W.

DIMENSIONS . . . . .

Height	13,3 cm (5-1/4")
Width (std. front panel)	48,3 cm (19")
Depth (w/o connectors)	35,6 cm (14")
Shipping Weight	5,9 kg (13 lbs)

*Specifications subject to change without notice.